NUTRITION FOR HEALTH

Holger Frederick Kilander

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Nutrition for Health

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PREFACE

Few subjects are of greater importance today than nutrition, for the future of the nation depends upon the development of healthy, well-nourished children and youth.

The need for better nutrition is not limited to those individuals who are ill fed or to the millions whose diets are borderline in character. Nutrition concerns all the people all the time, and it probably concerns more people more directly than any other problem or activity.

There are three ways by which nutrition can be improved: (1) by making nutritious foods easily available, and less desirable foods more difficult to obtain; (2) by improving the buying power of people so that those foods which are most essential can be within everyone's financial means; and (3) by helping people to become better informed about foods and nutrition.

The first two ways could produce quick results in improved nutrition *if* they could be applied broadly. However, the soundest procedure is that of making education in nutrition available to more people.

Through this book we seek to meet the following general objectives of nutrition education:

1. To become sufficiently informed about the scientific knowledge of foods and nutrition to be able to exercise sound judgment in food habits.

2. To develop an understanding of how to appraise one's daily food intake to determine its adequacy.

3. To develop the habit of selecting a well-balanced diet.

4. To appreciate the need for accepting responsibility for one's own food habits and those of one's family.

5. To develop an understanding of the principles involved in

food production, food conservation, food sanitation, and related problems.

6. To develop cooperation between the school, the home, and the community in furthering desirable food and nutrition education.

7. To develop an appreciation of national and world food problems.

Studies conducted by the author over a period of years have brought out that only about half the population above the eighth grade in education is sufficiently informed to be able to select a balanced diet, even when consideration need not be given to cost. On the basis of this research, the author has been led to conclude that a unit in nutrition education of 15 class periods is the minimum amount needed to make a person reasonably informed on nutrition for his own personal needs.

It may be helpful to present briefly the plan of the book by chapters:

Chapter 1, entitled "Nutrition Is Now a Science," presents an overview of the facts known about nutrition.

In Chapter 2 the Recommended Daily Dietary Allowances of the National Research Council are presented and discussed. The practical application of these allowances, known as the Basic Seven Food Groups, is given a preview in this chapter and later discussed more fully in Chapter 10.

In Chapter 3, entitled "Many American Diets Lack Necessary Nutrients," several studies of the nutritional and dietary status of various groups are described. This material should help the reader to understand that food deficiencies and food needs can be determined objectively and, therefore, are no longer a matter of opinion.

Chapters 4 through 9 consider each of the major groups of nutrients—carbohydrates, fats, proteins, minerals, and vitamins.

Chapter 10 includes detailed information on the Basic Seven Food Groups.

Chapter 11, entitled "Meals Should Be Planned," is most important. The previous chapters lead up to an understanding

of the scientific principles involved in meal planning and food selection.

In Chapters 12 and 13 the elementary facts of digestion are discussed and applications of these facts are made to health practices. Anatomical and physiological information is kept to the essentials.

The remaining chapters (14, 15, 16, and 17) consider four special phases of the subject of food and nutrition—namely, reducing and gaining body weight, food conservation, food sanitation and food laws, and superstitions and common misconceptions about food.

The activities listed at the end of each chapter are planned so as to correlate the factual material in the chapter with the food habits of the student and his family. The teacher should select carefully from these activities according to the amount of time available. The activities suggested should not only become a vital part of the study of nutrition but they should also be correlated with other subjects, such as science, home economics, health education, social studies, and mathematics.

The Appendix contains supplementary tables and other pertinent information which should be used as referred to in the text. Of special value is the extensive Food Value Table (Table 10) prepared by the U.S. Public Health Service. Its inclusion in this textbook permits the reader to analyze his own meals without having to go to other sources for information as to their calorie and nutrient content.

Application of nutrition information must be made not only in connection with class activities but wherever the question of meals and, therefore, food choice occurs. It is important that other teachers and other learning situations contribute to such education. Nutrition education should be applied in the preparation and selection of home-packed lunches and to meals eaten at home, in the school cafeteria, and in public restaurants. Suggestions for doing this are included.

Nutrition for Health is so planned that it can be used (1) for a course or a unit in nutrition; (2) for supplementary reading in

connection with courses in health education, home economics, general science, biology, and the social studies; and (3) for general reading by anyone interested in the subject of nutrition.

Teaching young people how to select food and getting them to want to choose proper diets is achieved more easily by having them participate in activities that correlate with the subject. It also depends upon guidance by the teacher in helping them to understand the value of the activities and the need for applying the knowledge learned to daily living. This is not an easy task, but it is one worthy of real effort.

H. F. KILANDER

ACKNOWLEDGMENTS

In the preparation of this textbook, numerous standard works on nutrition and education have been consulted, many of which are mentioned in the footnotes or are included in the bibliography. We are indebted to the scientists who have made possible the knowledge contained in these publications.

Credit is due the many high school and college students and adults who have provided insights into their food habits and data concerning their needs as regards nutrition and food information. Valuable help has also been obtained from various teachers of health, science, and home economics with whom the author has discussed content, methods, and illustrations.

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H. F. KILANDER

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EDITOR'S INTRODUCTION

It has become evident that among all the problems which have demanded solution since the end of World War II those concerning the supply and utilization of food for the peoples of the world are pre-eminent. The problem of helping to improve the health and save the lives of men in all nations depends not only on efforts to provide an efficient agriculture with increased production but also on a keen appreciation of what types of foods should be produced to do the most to accomplish these ends. Even in countries which have a surplus of food crops, there is evidence of limited knowledge as to what foods are best for the health of the individual and the welfare of the nation. This fact is verified by the large number of rejections due to nutritional deficiencies among the recruits during World War II.

All countries have among their citizens men and women who are well educated in the field of nutrition. A vast amount of knowledge has been amassed through research experimentation. But this is of little avail unless it has penetrated into the minds of the majority of people and has been translated into the establishment of good food habits.

Changes in one's mode of living should also make a change in the habits of the individual. Today machinery is helping to eliminate the need for much labor, and thereby a change is made in the food requirements of the individual, but there is evidence of only a slight alteration in eating habits. In addition, cold storage and improved and increased transportation facilities have made available a larger variety of foods, especially in the winter season. With so many new foods at our disposal and with the continual expansion of variety and supply it is not only desirable but essential that all people should be able to evaluate

them as to their proper place in the diet and the effect that they will have on their dietary balance.

To be effective, our knowledge of nutrition should be of a fundamental sort which will give a basis for judgment and action. This is the viewpoint of Dr. Kilander's book. In it he has set forth clearly and simply the basic facts concerning nutrition and has presented them in a way that should help to improve the physical state of the individual wherever he may live. The relationship of nutrition and its application to world problems is also presented. It is obvious that this nation cannot help the undernourished people of other countries unless its people have an intelligent viewpoint in regard to basic needs of individuals and groups. The more who understand the problem, the better is the chance of doing that which will relieve distress.

The study of nutrition is therefore one of the requirements for an understanding of world problems as well as those which are involved in individual well-being. For this reason fundamental knowledge of foods and their effect on individuals and society should be a basic requirement in the education of all children and youth.

HELEN JUDY BOND

NUTRITION FOR HEALTH

1

NUTRITION IS NOW A SCIENCE

> How to bring to all our people the benefits of the newer knowledge of nutrition as promptly as possible is both an educational and an economic problem. The teaching of the principles of nutrition, of the relation of nutrition to health, and of the nutritive values of foods should go on constantly both as a regular part of the work of schools of all grades, and through the various means of adult education.
>
> HENRY C. SHERMAN[1]

Nutrition is now a science because enough facts have been discovered through research to form a scientific basis for determining what foods we need to eat. We no longer need to depend upon hearsay, folklore, or tradition to be our guides in regard to what we should or should not include in our diets.

Today thousands of scientists are studying with chemicals, microscopes, animals, and human beings to obtain more information about foods and nutrition. This information is being used increasingly as a basis for meal planning in homes, schools,

[1] Mitchill Professor of Chemistry, Columbia University.

hospitals, and industrial plants of the United States and other countries. The facts from research in nutrition are also being applied by our government and our farmers to agricultural production.

In this book we shall present the basic scientific principles of good nutrition. We need to learn these facts and apply them for the benefit of our own health. Fortunately, you can learn and apply the rules in this game of "balanced diet" without detracting from the enjoyment of food.

What Is Good Nutrition and Poor Nutrition?

Health is a combination of many factors, of which nutrition is one of the most important. Good nutrition means to all of us better health and happier lives.

Good nutrition means right eating. It means an adequate diet. Good nutrition helps to promote strong and healthy bodies, better appearance, active and keen minds, greater resistance to disease, longer life, and a greater ability to enjoy life. It is important to remember that *without good nutrition no one can have optimum health.*

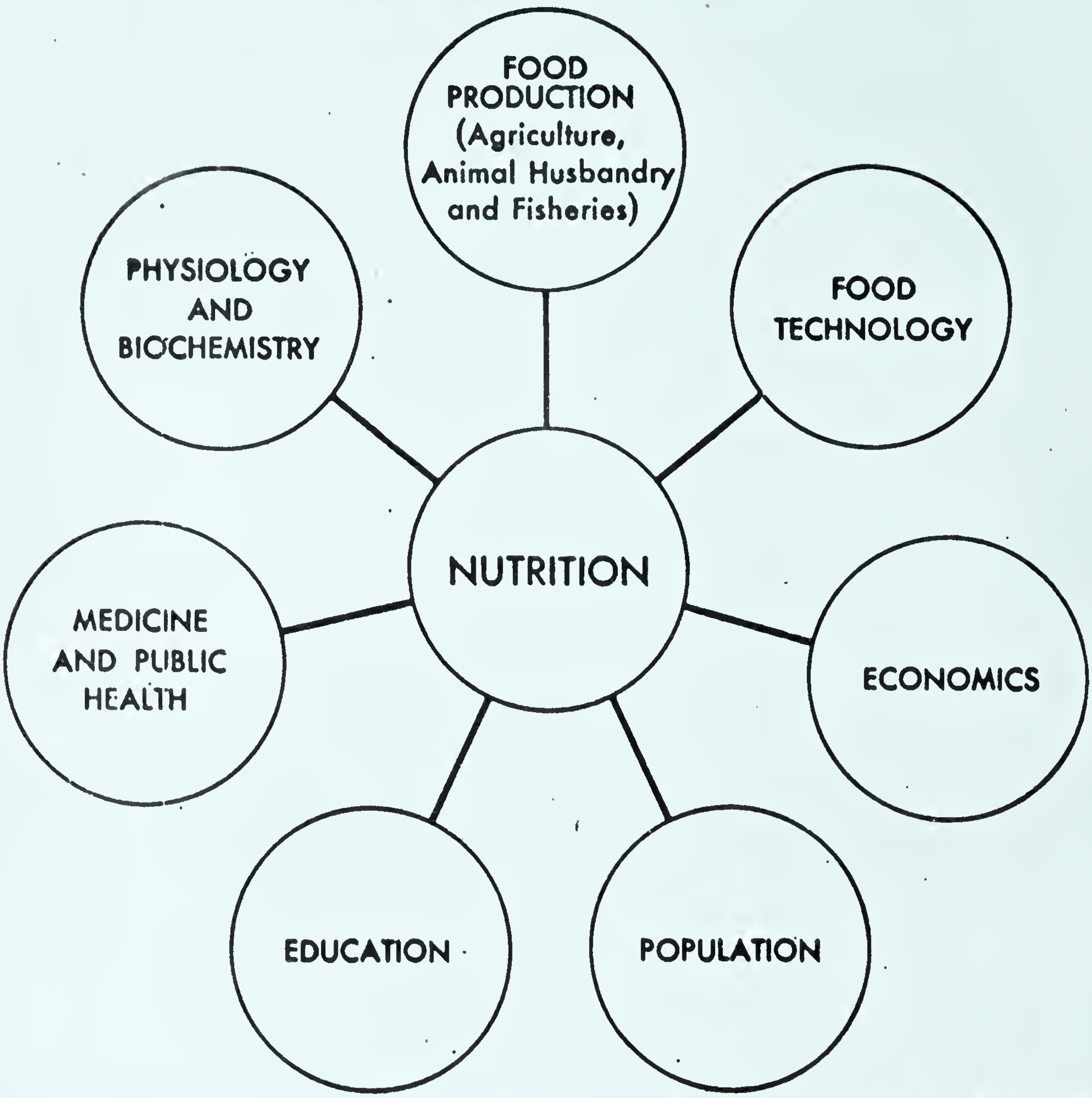
Poor nutrition means wrong eating. It means an inadequate diet. Poor nutrition may contribute to weak and undernourished bodies, bad teeth, poor mental development, lack of pep, nervousness, lowered resistance to disease, lack of endurance, and lessened ability to enjoy life. *Malnutrition* is the term applied to the consequences of an inadequate diet.

The consequences of poor nutrition are not so apparent, nor do they develop so quickly, as those which result from accidents, from germs, or from chemical poisons. Yet the consequences of poor nutrition eventually do show up.

When we select our food by chance or in haste or on the basis of personal likes and dislikes, we are gambling with our health. Is it wise to risk efficiency, vitality, and appearance by not knowing what good eating habits are?

The results of inadequate diets divide into two types—*hollow hunger* and *hidden hunger*. Hollow hunger results from an insuffi-

Subjects Related to Nutrition



Courtesy Food and Agriculture Organization of the United Nations

The contributions of many fields of study have helped to give us better nutrition.

cient quantity or volume of food. It is felt in the stomach. People are usually aware of hollow hunger and therefore will take steps to alleviate it by trying to obtain sufficient food. *Starvation* is the name for prolonged hollow hunger. In this country we seldom see cases of actual starvation, but there are millions of cases of starvation in other parts of the world.

Hidden hunger results from insufficient amounts of the protective foods—vitamins, minerals, and proteins. It may be present without the individual's knowing it; it may be present even when the individual eats sufficient food as far as quantity is concerned; it may even be present in some apparently well-fed

individuals. It is hidden hunger which is our greater danger in this country. Therefore, we want to avoid it by learning about good nutrition.

Extreme deficiencies of specific food essentials do not occur very often today in this country. However, certain pronounced deficiencies in the diet do exist, and their effects have been known for a long time. For example, it is known that scurvy is caused by a lack of vitamin C, and rickets by a lack of vitamin D.

Partial deficiencies in the diet, however, are much more common than pronounced deficiencies. Such ailments as night blindness, caused by a partial lack of vitamin A, and bleeding gums, arising from insufficient vitamin C, are examples of the effects of partial deficiencies.

It is variously estimated that 40 to 70 percent of the population of the United States is suffering from some form of malnutrition because of deficiencies in their diets. Such is the case in spite of the fact that the United States has more food than most other countries in the world.

Do you realize how much food you will eat in your lifetime? More than 100,000 pounds! Will the large quantity that you consume be of high quality from a nutritional and, therefore, a health standpoint?

Why Should You Be Informed about Nutrition?

One way to be assured that you are obtaining high-quality food is to develop good food habits. But in order to do so, you must, first, know what good food habits are and, second, understand their value so that, when once developed, you do not permit them to become lost, weakened, or replaced by poorer ones.

Today informed people understand that it is important to have adequate knowledge of the value of good food habits, even though some of their ancestors seemingly managed to get along without such information. We should desire to live even better than our ancestors did—nutritionally speaking.

Today, when large numbers of children, young people, and adults eat away from home, it becomes each person's own

Courtesy Trans World Airlines

No matter where or when you eat, your food counts for or against you nutritionally.

responsibility to be able to select food wisely. There is no one to select your food for you in a restaurant or cafeteria. And, even at home, you will need to use your knowledge of food selection in order to improve the family diet.

To understand good nutrition, you will want to know the answers to these questions: Just how much information have scientists discovered to date on the subject of nutrition? Which facts from this body of knowledge are essential to an understanding of nutrition as it affects me and my family?

The remainder of this chapter will give you briefly the answers to these and other questions. In the following chapters we shall enlarge on some of these questions.

What Have Scientists Discovered about Nutrition?

It seems rather obvious that a relationship must exist between the chemical composition of our bodies and the foods which we eat. Therefore, let us look at the human body as a chemist might

do when he becomes interested in knowing the kinds and the amounts of the various chemical elements of which some substance is made and then see how this relates to the composition of food.

The chemical make-up of the human body. You, and every other human being, are made up of approximately 17 different chemical elements of the 92[2] known to exist on this earth. Table 1 gives the chemical composition of the human body in percentages and pounds for an average-sized man who is usually represented as weighing 154 pounds.

All of these 17 elements must be supplied to our bodies through food or drinking water. Part of the oxygen is, of course, obtained from the air. These elements are not present in the body as free elements but are combined in hundreds of ways to make the various chemical compounds which add up to being the human body—YOU. The following list of comparisons will give you some idea of the amounts of these chemicals in the body. The average man contains

as much hydrogen as is found in 70 quarts of water.
as much iron as is found in a small nail.
enough iodine to make a drop of tincture of iodine.
sufficient calcium for making slaked lime to whitewash a small chicken coop.
enough fat for seven bars of soap.
enough phosphorus for 2,200 match tips.
sufficient magnesium for a dose of magnesia.
enough sulfur to rid a dog of fleas.
as much sugar as will fill one sugar shaker.
sufficient potassium to explode a toy cannon.
as much oxygen as there is in 15,000 quarts of air.

The composition of food. One of the chief functions of food is to build and repair body tissues. Therefore, food ought to resemble human tissue in its chemical composition. And that is what it

[2] This number represents the naturally existing elements. It does not include those which have been artificially created, such as plutonium.

TABLE 1

Approximate Chemical Composition of the Adult Human Body*

Element	Approximate percentage of body	Weight in 154-lb man (70 kg)
Oxygen	65.0	100.0 lb
Carbon	18.0	27.7 lb
Hydrogen	10.0	15.4 lb
Nitrogen	3.0	4.6 lb
Calcium	1.5–2.2[1]	2.3–3.4 lb
Phosphorus	0.8–1.2[2]	1.2–1.9 lb
Potassium	.35	8.6 oz
Sulfur	.25	6.2 oz
Sodium	.15	3.7 oz
Chlorine	.15	3.7 oz
Magnesium	.05	1.2 oz
Iron	.004	0.1 oz
Manganese	.0003	.007 oz
Copper	.00015	.004 oz
Iodine	.00004	.001 oz
Cobalt[3]		
Zinc[3]		
Others found, but of doubtful function		

[1] Estimates of normal calcium content vary widely.

[2] Phosphorus varies with calcium.

[3] Believed to be essential, but as yet there is no consensus on quantitative estimates.

Note: For an explanation of abbreviations used in the tables, see Table 12, on page 354.

* Adapted from H. C. Sherman, *The Chemistry of Food and Nutrition*, The Macmillan Company, New York, 1946, 7th revised edition, p. 226.

does, for the human body and food—whether from plant or animal sources—are chemically alike in that they are made up of the same chemical elements and many of the same chemical compounds.

Foods are composed of several chemically related groups, or classes, which are essential in human nutrition. These groups are the carbohydrates, fats, proteins, minerals, and vitamins, as well as water and bulk.

The food groups, or classes, consist of specific chemical substances, known as *nutrients*, which our bodies require. Nutrients are made up of various combinations of the 17 chemical elements

Courtesy Florida State Board of Health

Doctors on the State Board of Health in Florida travel from town to town in a laboratory trailer to give physical examinations for determining the nutritional status of high school students.

found in the body. A food may consist of one, several, or many different nutrients. Several thousand foods have been analyzed to date to determine their chemical make-up in terms of quality and quantity of nutrients.

In making a food analysis, three types of methods may be used: chemical tests, animal-feeding experiments, and microbiological experiments.

A number of chemical tests are available for determining the amounts of various nutrients in foods. Some of these tests can easily be demonstrated in a chemistry laboratory.

In animal-feeding experiments, animals like the guinea pig, the white rat, and the hamster are used. The hamster is the latest addition to the list of animals used for food experiments, having recently been brought to the United States from Syria. Some simple animal-feeding experiments are described in Appendix E on pages 386--389.

Microbiological experiments are dependent upon the fact that bacteria require vitamins, just as man and animals do. When an essential nutrient is missing in the food or medium upon which the bacteria are living, they do not grow and multiply. When the missing nutrient is added to the medium, the bacteria grow rapidly. The rate of growth of the bacteria is an indication of the amount of the particular nutrient present. Microbiological experiments are used largely in determining the vitamin content of foods.

Today the kinds and the amounts of nutrients present in the foods commonly eaten are fairly well established. Table 10, in Appendix A, shows the chemical composition of most of the commonly eaten foods.

The nutrients required by the human body. At the present time it is believed that a nutritionally complete diet must provide 40 or more nutrients in addition to water and calories. These 40 nutrients, required for growth and maintenance of human beings, can be grouped as follows:

10 amino acids: Proteins are made up of various combinations of 22 amino acids, of which 8 to 10 are considered essential.

13 minerals: The 13 minerals and associated elements listed in Table 1 are essential. There undoubtedly are others, but sufficient proof of their presence or value is not as yet available.

15 vitamins: These include the four fat-soluble vitamins—A, D, E, and K—and the 11 water-soluble vitamins—ascorbic acid (C), thiamine (B_1), riboflavin (B_2), niacin, choline, folic acid, biotin, inositol, pyridoxine, pantothenic acid, and para-aminobenzoic acid.

1 fatty acid: Linoleic acid is obtained from certain fats.

1 glucose: The carbohydrates—starches and sugars—are converted into glucose through digestion.

Much information is available about some of these 40 nutrients, whereas additional facts need to be discovered about others.

Although at the present time it is known that these 40 nutrients are essential for the needs of the body, it is not certain that these 40 nutrients serve all the needs of the body. In other words, it

Courtesy Bureau of Human Nutrition and Home Economics

This rat was given only meat, potatoes, bread and butter. His poor fur, small weight (89 grams), and small bones show the lack of calcium and vitamins.

may be that we need other nutrients in addition to these 40 nutrients for total health. For example, it has been found that some animals who are fed on all the 40 listed nutrients live but do not grow. Others may grow, but in some way the growth of the next generation is affected. The conclusion to be drawn from such findings is that there are additional nutrients not yet known that are necessary for complete growth of the body. If this is true of animals, it is no doubt true of human beings. Therefore, scientists are at work trying to find what the additional nutrients are, in addition to the 40 already known, that are necessary to meet the total needs of the body.

All of these 40 nutrients can be extracted from food in the laboratory, and some of them—such as certain vitamins and amino acids—can be made synthetically.

The functions of the nutrients. Each nutrient serves at least one of the following general functions when taken into the body: (1) it yields heat and energy; (2) it builds and renews body tissue; or (3) it regulates body processes of various types.

Courtesy Bureau of Human Nutrition and Home Economics

This rat was given plenty of milk and vegetables, besides meat, potatoes, bread and butter. As a result, his bones are strong and well formed and he weighs 194 grams.

Since a given food class, or group, is made up of one or more nutrients, a food class will also serve one or more of the three functions just stated. Also, since a given food is made up of one or more food classes, and therefore of one or more nutrients, that food will also serve one or more of the three functions listed, depending upon its nutrient make-up. Consequently, the value of a given food, such as bread, carrots, or milk, will depend upon the kinds and amounts of nutrients which it supplies.

The following list gives the food classes or nutrient groups and their general functions:

Carbohydrates, from which glucose is derived, supply heat and energy. The unit for measuring the energy value of foods is called the calorie.

Fats also supply energy and heat. They are high-calorie foods, capable of yielding more than twice as much energy as carbohydrates.

Proteins, from which the amino acids are derived, build and repair body tissue. They also can supply heat and energy, although this is not their chief function.

Minerals build tissue and regulate body processes.

Vitamins aid growth and help to regulate body processes.

Water acts as a medium for transporting materials in the body and aids in the elimination of waste and in the regulation of body temperature.

Regulatory bulk, also called *roughage*, aids in digestion. Cellulose in plant foods is the most common type of bulk. Roughage is not absorbed into the blood stream, since it is not digestible; therefore, it is ordinarily not classified as a nutrient. It is included here because it does contribute something desirable to the diet.

Table 2 classifies the nutrients by the functions which they perform. More detailed discussions of these functions will be given in the following chapters.

TABLE 2

The Major Functions of Nutrient Groups

Nutrient groups or food classes	Functions		
	To supply heat, energy, and power	To build and renew tissue and promote growth	To assist in regulating body processes
Carbohydrates	X		
Fats	X		
Proteins	X	X	X
Minerals		X	X
Vitamins		X	X
Water			X
Bulk, roughage[1]			X

[1] Bulk, or roughage, is technically not a nutrient but is included in this table because it assists in the digestion of food.

The amounts of nutrients required. In 1941 the National Research Council issued a statement telling how much of each of 10

of the nutrients were needed in the diet of the average person. The 10 nutrients were food energy (calories), protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin, ascorbic acid (vitamin C), and vitamin D. Before that year there had been no generally accepted standards, although the leading nutrition experts had their individual ideas and recommendations in regard to the amounts of the various nutrients needed.

These recommendations of amounts needed are called the Nutrition Yardstick. These amounts are given in Table 3 on page 26, and are now considered the basis for judging the adequacy of our diets. The Nutrition Yardstick shows how much of each of these nutrients is needed for individuals of different age and sex and for varying degrees of physical activity. We should all use it as our guide. In fact, the Nutrition Yardstick is so important that we are devoting all of the next chapter to it. This Yardstick will then be the basis for the discussions presented in each of the remaining chapters.

It should be emphasized that, *if provision is made for these 10 known nutrients in the diet, it is very probable that the other nutrients, which are less understood, and others which are not yet discovered, will also be present.*

What Can You Discover about Your Nutrition?

Now that you have read something of what scientists have discovered about the composition of food and its relationship to the human body, you will want to know just how this knowledge can be applied to yourself. The following three techniques can be used for determining whether or not a person is getting adequate amounts of the needed nutrients:

1. A study of the diet, using the Nutrition Yardstick as a guide, may indicate in what respects the individual's diet is adequate or deficient in regard to specific nutrients.

2. A medical examination by a physician will show up certain signs which point to adequate or inadequate nutrition. The American Medical Association lists the following items as symptoms of malnutrition.

SYMPTOMS OF MALNUTRITION*

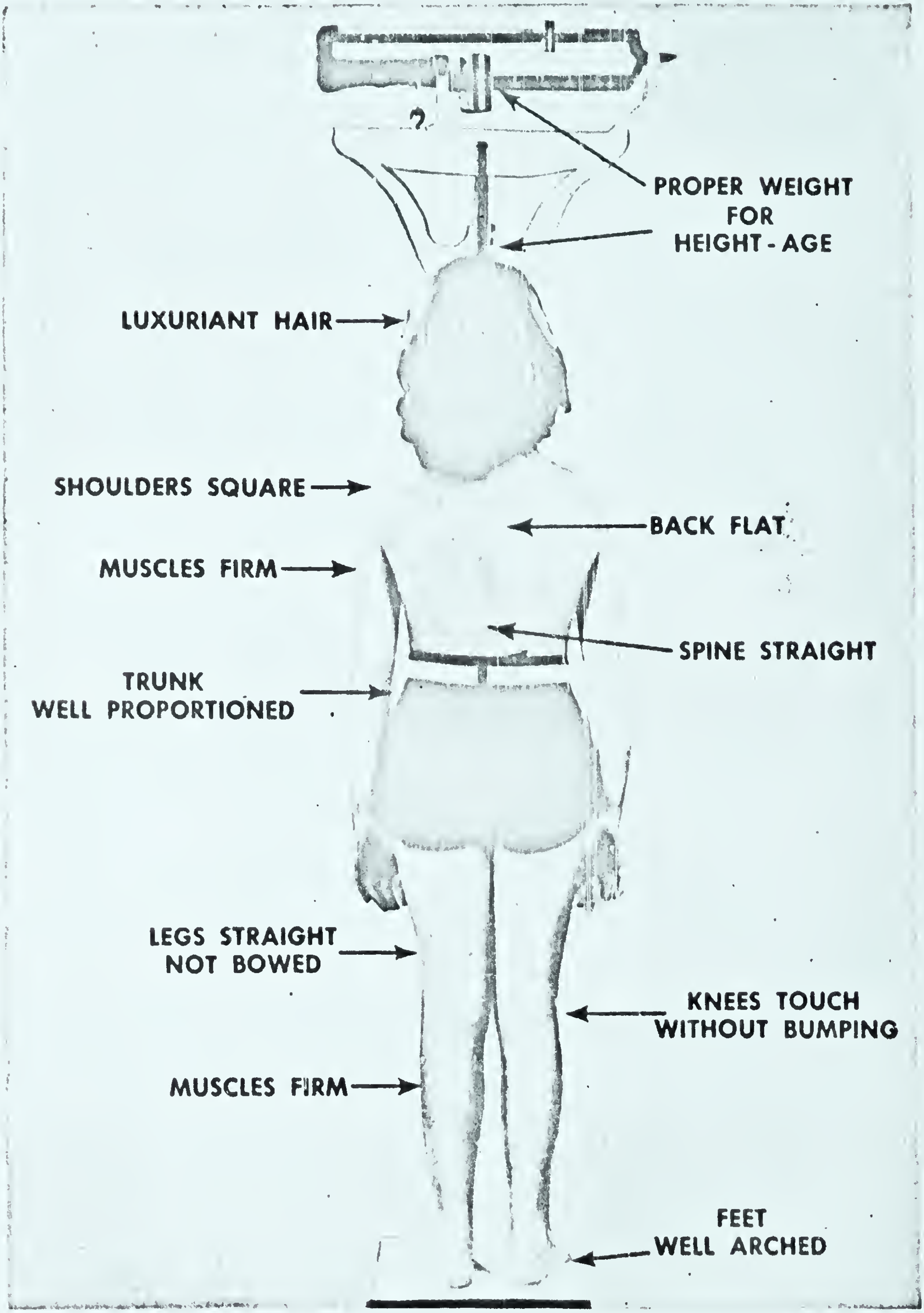
In Infants and Children	*In Adolescents and Adults*
Lack of appetite	Lack of appetite
Failure to eat adequate breakfast	Lassitude and chronic fatigue
Failure to gain steadily in weight	Loss of weight
Aversion to normal play	Lack of mental application
Chronic diarrhea	Loss of strength
Inability to sit	History of sore mouth or tongue
Pain on sitting and standing	Chronic diarrhea
Poor sleeping habits	Nervousness and irritability
Backwardness in school	Burning, prickling of skin
Repeated respiratory infections	Abnormal intolerance of light
Abnormal intolerance of light	Burning or itching of eyes
Abnormal discharge of tears	Abnormal discharge of tears
Bad posture	Muscle and joint pains, muscle cramps
Sores at corners of mouth	Sore, bleeding gums
	Sores at corners of mouth

* From *Hygeia*, The Health Magazine, March, 1942. Copyright, 1942, by the American Medical Association.

A person's weight in relation to height, age, and sex is one of the signs of health and nutritional state. Tables 21 and 22, in Appendix C, give the recommended figures on weight. A study of an individual's bone structure, as determined by X-ray, can give further information about growth and aging. The medical examination may also include a basal metabolism test.

3. A number of chemical and biological tests can be used to determine the presence and amounts of certain nutrients in the body tissues—particularly in the blood and the urine. By means of such tests it is now possible to determine whether or not there is a lack of protein, iron, vitamin A, vitamin C, and vitamin K in the human body. Tests for determining the amounts of other vitamins and minerals present have not been developed far enough to be of practical value but will no doubt be refined for use before long. It is now possible to make an analysis of eight nutrients in as little as one-tenth of a cubic centimeter—15 drops—of blood.

Signs of Health and Good Nutrition



Courtesy California Fruit Growers Exchange

Various signs indicate a well-built body—developed through a balanced program of proper food, exercise, and sleep.

A combination of the above three procedures should give a reliable picture of a person's nutritional state, provided that these procedures are carried out and interpreted by qualified individuals.

What Other Advances Have Contributed to Our Nutrition?

There have been a number of other scientific and technological advances in recent years which have been contributing considerably to our understanding of nutrition and to the improvement of our diets. Advances are briefly discussed in relation to the following three subjects: (1) factors which affect the amounts of nutrients in various foods; (2) the preparation of synthetic nutrients; and (3) improvements in the storage, transportation, and processing of foods.

What factors affect the nutrients in foods? Many factors and conditions increase, reduce, or destroy the value of the various nutrients either in the growing plant or after the food has been harvested.

It has been established that the vitamin content of foods varies with the season, the climate, the rate of growth of a plant, and the plant strain, as well as with the nutrients available to the plants in the soil and water.

For example, when cows are in pasture, the milk produced contains two to four times more of vitamins A and D than at other seasons when green grass is not available. Consequently, the vitamin content of milk products, such as butter, cream, and cheese, will vary with the seasons.

The iron content of lettuce raised on one soil may be 50 times more than that raised on some other soil. The amount of calcium in cabbage grown under different conditions may vary as much as 400 percent. The vitamin C content of tomatoes may vary as much as 300 percent.

If the local soils are deficient in one or more chemicals, then the products from these soils will be deficient in similar respects. For example, iodine has been leached out of the soils around the Great Lakes of the United States and so the goiter rate among

people there is higher than in most other parts of the country.

More recent studies have been made relating to the nutrient losses which occur between the time food is harvested and the time it is placed on our dinner table. Certain procedures in food processing, storage, and cooking are known to cause the destruction or loss of a high percentage of certain vitamins, minerals, and amino acids. In Chapter 15 this subject is given more detailed consideration.

For years farmers have made studies to find out what factors produce the best plants and animals. These studies have brought about improved nutritional qualities to many plants and animals. But to take advantage of these gains we must see to it that the values in foods produced on the farm are actually present when the foods reach our table.

Because of the variations in the amounts of certain nutrients in foods, the figures given in tables on food values (Table 10 in Appendix A) represent averages, or the most frequent findings obtained from many samples of foods.

To what extent can nutrients be made synthetically? Many of the known nutrients have been made synthetically in chemical laboratories—chiefly the vitamins. All the mineral nutrients except sulfur can now be supplied as simple salts in forms which can be utilized by the human body.

It is well to understand, however, that scientists are not expecting that synthetic foods will be able completely to take the place of natural food. It is very doubtful that we shall ever reach the time when a meal will consist merely of taking a pill. The reason is that the minimum normal needs of an adult in starch, fat, amino acids, minerals, and vitamins for one day amount to nearly 1 pound, not counting water needs. It has been estimated that if this amount of food were put in the most concentrated form it would mean a pill the size of a hen's egg for each meal.

Some of the nutrients are now being made commercially in quantity and at prices which permit them to be an important factor in our national diet. Some of the vitamins are made synthetically, and others are obtained in concentrated forms

Courtesy General Electric Company

The vitamin crystals shown above represent the average daily needs for carotene, vitamin C, and thiamine. The food shown below—two cooked pork chops and a serving of broccoli—would supply these needs.

Courtesy General Electric Company

from vitamin-rich foods. Synthetic or concentrated forms of nutrients may be of value in supplementing inadequate diets or for use in special cases under medical supervision.

In order that a large number of people might receive the benefits from some of these synthetic and concentrated forms of nutrients, they are being added to cheap, staple foods. Iodine has been added to table salt for some time. We can now obtain milk fortified with vitamin D, and we can get flour and bread enriched by the addition of several vitamins and minerals. During World War II many of the synthetic vitamins were included in special army rations and in lend-lease shipments. A large variety of commercial vitamin and mineral pills are today obtainable in drugstores. The question of whether or not to use vitamin and mineral concentrates is discussed on page 113.

What other discoveries have improved our diets? Certain discoveries and advances in the storage, transportation, and processing of foods have contributed to the improvement of the diets of the American people.

Improved methods for storing—particularly as regards canning and refrigeration—have made available to us many foods during all seasons of the year as well as from distant farms and lands. The speed-up in transportation has made foods available that otherwise would become perishable in shipment. One of the discoveries hastened by World War II is that of dehydrated or powdered foods. Many new edible plants are being transplanted from other countries to areas of the United States where the climate and soil are suitable.

It is now possible to eat practically the same types of meals at any season of the year in any one of our 48 states. We should be appreciative of this achievement.

Modern farm technology, including machinery and soil-conservation methods, improvements in food transportation, storage, processing, and distribution, and use of the relatively untapped food sources available from the oceans will no doubt make it possible for the world to maintain more of its population on better diets. To the extent that this is done, malnutrition, famine, and starvation will be reduced.

Of What Use Is This New Knowledge to Us?

We can say in summary that more is known about foods and nutrition today than ever before. Such information is now available to help us plan and enjoy the benefits of good diets.

There is unfortunately a big gap between what scientists already know about what we should eat and what most people know and are willing to apply. There is a serious lag in getting these essential facts to the general public. There is a further lag in convincing the individual that it is to his personal interest to improve his food habits in light of modern scientific knowledge.

If you wish to benefit by these many marvelous discoveries about food and nutrition, *you* will need to become informed on the facts and make application of them in your own and your family's food habits.

The remaining chapters will expand upon many of the topics presented in this introductory chapter.

For Review

1. What is meant by "hollow hunger"? By "hidden hunger"?
2. How many chemical elements are found in the human body?
3. To what extent has the composition of foods been determined?
4. How many nutrients are known to be required by the human body?
5. Name the five groups of nutrients.
6. What are the three major functions of food?
7. Have scientists determined how much we need of the various nutrients?
8. What are the three techniques used for determining whether a person is adequately fed? Which of these techniques is it possible for you to learn to use?
9. What are some of the factors which influence the amounts of nutrients contained in different foods?
10. To what extent can food (nutrients) be made in the chemical laboratory?
11. What advances in the storage and processing of foods have contributed to an improvement in our diets?

For Personal Application

1. Determine from the tables in Appendix C what your weight should be for your age, height, and sex. Do the same for the other members of your family.
2. Prepare a list of the foods you eat for one complete day. Arrange it in a table like that in Appendix B on pages 366 and 367. You will need to have this table ready for one of the activities given at the end of the next chapter. If you have a postage scale at home, use it to determine accurately the amounts of the various foods which you have eaten; otherwise, you will have to list approximate amounts or servings.
3. Prepare additional tables of the foods eaten on other days and have them in readiness for later assignments. It would be especially desirable to have seven such tables covering one complete week.
4. Of the foods eaten on any given day, which ones are available to you because of modern methods of storage, transportation, and processing?
5. Visit a children's hospital, if possible, and observe cases of children that have a malnutrition background.
6. Have a complete nutritional study made of yourself at your community hospital or by a local pediatrician. Improve your diet in accordance with the needs shown by the results of the examination.

2

OUR FOOD NEEDS ARE MEASURED BY THE NUTRITION YARDSTICK

> For the first time, the top experts in the Nation have drawn the specifications for a diet adequate for good health—a gold standard for nutrition. These blueprints will have meaning only if each one of us can and will translate the specifications into a wiser selection of what goes into our stomachs every day.
>
> THOMAS PARRAN, M.D.[1]

This chapter is about the Nutrition Yardstick, or the table of amounts of the 10 essential nutrients needed for a balanced diet. The Nutrition Yardstick is also known as the Recommended Daily Dietary Allowances and is given in Table 3. It is one of the most important documents of our time.

For practical application, the Recommended Daily Dietary Allowances have been reinterpreted into food groupings which supply the 10 nutrients listed. These food groupings are called

[1] Former Surgeon General, U.S. Public Health Service, referring to the Nutrition Yardstick when it was set up in 1941.

the Basic Seven Food Groups and are shown in the chart on page 31.

The Nutrition Yardstick

In 1940 a Committee on Food and Nutrition was set up by the National Research Council to advise on nutrition problems in connection with national defense.

This Committee of nutrition experts made recommendations, based on the scientific information available, which were adopted for use in 1941. The recommendations of the Committee are referred to as the Nutrition Yardstick or, more technically, as the Recommended Daily Dietary Allowances.

The Nutrition Yardstick will serve as a guide for most of the discussions in the remaining chapters of this book. We shall have you use it to check your own diet for each nutrient listed. In that way you will be reasonably sure about how well you are eating and what deficiencies need to be corrected through a better choice of foods. Therefore, it will be helpful to understand the significance of the Nutrition Yardstick, as explained in the following pages of this chapter.

What the Nutrition Yardstick provides. The allowances for the nutrients given in Table 3 are intended as a guide in planning an adequate diet for everyone. The quantities given are planned to provide not only the minimum needs necessary to protect against actual deficiency diseases but also for a margin of safety sufficiently high to ensure good health and protection of all body tissues.

These allowances will be revised from time to time as new investigations give us new evidence. In the meantime the amounts of nutrients recommended in the Nutrition Yardstick *should be used as recommended allowances rather than as absolute allowances.* In light of what we *now* know, the amounts given in Table 3 are the best recommendations that can be made.

The 10 nutrients listed in Table 3 are food energy (calories), protein, calcium, iron, and six vitamins—vitamin A, thiamine, riboflavin, niacin, ascorbic acid (vitamin C), and vitamin D. We

TABLE 3

The Nutrition Yardstick (Recommended Daily Dietary Allowances)

Family members	Food energy (cal)	Protein (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)	Vitamin D (I.U.)
Children up to 12 years:										
Under 1 year	[1]	[2]	1,000	6	1,500	0.4	0.6	4	30	400
1–3 years (27 lb)	1,200	40	1,000	7	2,000	0.6	0.9	6	35	400
4–6 years (42 lb)	1,600	50	1,000	8	2,500	0.8	1.2	8	50	400
7–9 years (58 lb)	2,000	60	1,000	10	3,500	1.0	1.5	10	60	400
10–12 years (78 lb)	2,500	70	1,200	12	4,500	1.2	1.8	12	75	400
Girls:										
13–15 years (108 lb)	2,600	80	1,300	15	5,000	1.3	2.0	13	80	400
16–20 years (122 lb)	2,400	75	1,000	15	5,000	1.2	1.8	12	80	400
Boys:										
13–15 years (108 lb)	3,200	85	1,400	15	5,000	1.5	2.0	15	90	400
16–20 years (141 lb)	3,800	100	1,400	15	6,000	1.7	2.5	17	100	400
Women (123 lb):										
Sedentary	2,000	60	1,000	12	5,000	1.0	1.5	10	70	[3]
Moderately active	2,400	60	1,000	12	5,000	1.2	1.5	12	70	[3]
Very active	3,000	60	1,000	12	5,000	1.5	1.5	15	70	[3]
Pregnancy (latter half)	2,400[4]	85	1,500	15	6,000	1.5	2.5	15	100	400
Lactation	3,000	100	2,000	15	8,000	1.5	3.0	15	150	400
Men (154 lb):										
Sedentary	2,400	70	1,000	12	5,000	1.2	1.8	12	75	[3]
Physically active	3,000	70	1,000	12	5,000	1.5	1.8	15	75	[3]
With heavy work	4,500	70	1,000	12	5,000	1.8	1.8	18	75	[3]

Notes on Table 3

Source of table: Recommended Dietary Allowances, National Research Council Reprint and Circular Series No. 129, revised 1948. This table is a goal, subject to revision, toward which to aim in planning practical diets. The recommended allowances can be attained with a good variety of common foods which will also provide other minerals and vitamins for which requirements are less well known. For further recommendations and explanations, see the National Research Council's publications.

Footnotes:

[1] 110 calories per 2.2 pounds (1 kg) body weight at 6 months. (Energy requirements are 120 calories per 2.2 pounds in early infancy and 100 calories per 2.2 pounds at 1 year.)

[2] 3.5 grams per 2.2 pounds (1 kg) body weight.

[3] For persons who have no opportunity for exposure to sunshine and for elderly persons, the ingestion of small amounts of vitamin D may be desirable.

[4] The value of 2,400 calories represents the allowance for pregnant, sedentary women. If more active, additional calories may be needed.

Note: Thiamine is also known as vitamin B_1 and ascorbic acid as vitamin C.

Courtesy "Food Engineering"

With the large assortment of foods available in our modern markets, there is no reason why the dietary needs of the family cannot be met with a variety of foods and within the budget.

shall leave the discussion of these 10 nutrients and their functions for later chapters. At this point all you need to know is that there are the 10 nutrients for which recommended allowances have been set.

What the Nutrition Yardstick does not provide. Other nutrients which are known to be necessary to the human body are not included in the Nutrition Yardstick because the amounts required in the daily diet have not as yet been fully determined. Fortunately, the foods from which we obtain the 10 nutrients known to be essential usually supply the additional nutrients that are not included.

The amounts of each nutrient listed are those which we should actually consume. No allowances have been made for any vitamin and mineral losses occurring in cooking. Therefore, it is necessary to make provision for such losses when calculating the amounts of various foods required. The matter of losses is considered at length in the chapters on minerals, vitamins, and food conservation.

An abundance of fruits and vegetables in the market basket assures the shopper that her family will obtain an ample supply of vitamins and minerals.

Courtesy U.S. Office of Education

How the Nutrition Yardstick was planned for everyone. The Nutrition Yardstick was planned so as to give recommended amounts of all 10 essential nutrients for both sexes at all ages from birth to death, as well as for women in pregnancy. Of course the amounts suggested are for healthy, normal people, of average size.

By looking at the left column of Table 3, you will see that allowances are the same for both boys and girls up to twelve years of age. The figures given for children up to twelve are for the middle year in the age group and for children of average size who have an average amount of activity.

The figures for young people over twelve are listed separately for boys and girls because at the age of twelve the rate of growth and the amount of physical activity begin to differ for the two sexes.

The allowances recommended for adults are for average-sized people—a 154-pound man and a 123-pound woman. Because the physical activity among adults varies so greatly and makes

such a change in certain nutrient requirements, allowances for adults are given for sedentary people, moderately active people, and very active people, defined as follows:

Sedentary people include those engaged in office work, light housekeeping, clerking, or any other kind of work that requires little muscular effort.

Moderately active people are those engaged in such work as carpentry, routine farm labor, waiting on tables, factory work, or doing housework on a farm or in a large home.

Very active people include the ones who spend 8 or more hours a day at such work as lumbering or very heavy housework.

The allowances in the Nutrition Yardstick vary proportionately according to a person's weight or amount of activity.

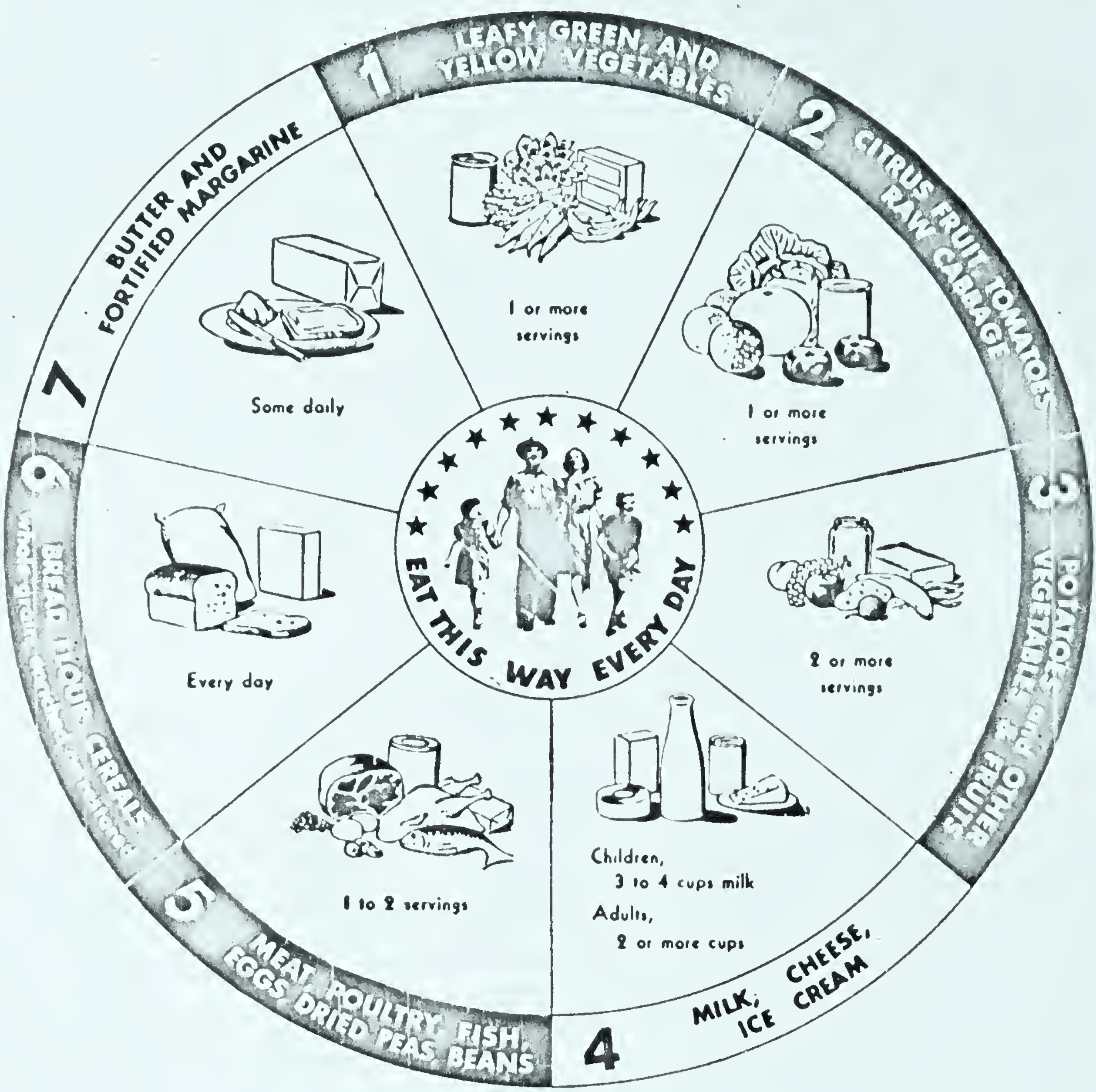
The needs for people who are ill may vary considerably from these figures, but that is a matter for the physician and outside the scope of this book.

The Nutrition Yardstick and national food requirements. Statisticians have figured out a way to use the Yardstick for determining the nutrient needs, and therefore the food needs, of large groups of the population—such as all the people of a community, a city, a state, or a nation—on the basis of population distribution. In figuring out the food needs of a large group of people, consideration is given to the percentage of people among the group in each of the age and sex classifications listed in Table 3.

From the total findings, then, an average can be computed per person for the group. For example, the *average* daily figures arrived at for each individual in our country's total population are as follows:

Food energy	2,800 cal
Protein	66 gm
Calcium	900 mg
Iron	12 mg
Vitamin A	4,700 I.U.
Thiamine	1.4 mg
Riboflavin	1.9 mg
Niacin	14 mg
Vitamin C	70 mg

The Basic Seven Food Groups



Courtesy Bureau of Human Nutrition and Home Economics

A detailed discussion of the Basic Seven Food Groups and extensive lists of foods in each group are given in Chapter 10.

By comparing the afore-mentioned figures with the total amount of nutrients in our annual food crop, the U.S. Department of Agriculture is able to determine in which nutrients our country is adequate or deficient. Any country can do the same. On the basis of such findings, scientific planning can be applied to determine what changes might be desirable in the amounts of certain kinds of foods raised and in the amounts or kinds of foods imported and exported.

The Nutrition Yardstick has been widely accepted and used by welfare and government agencies. It has, consequently, set

the common nutritional goals for our country and to some extent also for some other countries.

The Nutrition Yardstick has been translated for use. The amounts of the various nutrients listed in Table 3, with the exception of vitamin D, can be obtained through a good diet of natural food if careful consideration is given to selection and methods of food preparation. Consequently, to be useful, the information given in the Nutrition Yardstick must be translated into terms of actual foods and quantities—that is, into groups of foods that are appropriate for planning diets and meals.

The Basic Seven Food Groups

The technical information in the Nutrition Yardstick has been translated by the government into more understandable language in the form of the Basic Seven Food Groups, as shown in the chart on page 31. (See also Chapter 10.)

The foods included in the seven groups. The common foods available in this country have been grouped on the basis of similarity in the types of nutrients which they contain. Everyone should daily eat foods from each of the seven groups.

Group 1 includes green and yellow vegetables—raw, cooked, frozen, or canned. Most of these vegetables provide vitamin A value. The foods in Group 1 are also rich in vitamin C and iron and are good sources of riboflavin. If the foods in this group are carefully prepared, they also may be worth-while sources of B vitamins and calcium.

Group 2 includes oranges, grapefruit, and other citrus fruits, tomatoes, raw cabbage, and salad greens. All these foods are important sources of vitamin C. The best year-round sources of this vitamin are the citrus fruits and tomatoes. When in season, several other foods can be used instead of these. Fresh strawberries, cantaloupes, and pineapples contain considerable vitamin C, as well as certain other vitamins and minerals needed every day.

Group 3 consists of potatoes and other vegetables and fruits not included in the first two groups. Potatoes are very important

because they make many contributions to the diet. They are a better source of food energy and protein than most vegetables and fruits and, in the quantities in which they are commonly consumed, they furnish important amounts of iron, B vitamins, and vitamin C. The other foods included in this group are not outstanding as a source of any specific nutrient but, like potatoes, become important because of the quantities in which they frequently are consumed.

Group 4 includes milk and milk products. These are very important sources of high-quality protein and are outstanding sources of calcium and riboflavin—nutrients commonly deficient in American diets.

Group 5 is made up of the principal animal-protein foods, including meats, fish, poultry, and eggs, and of the plant foods high in proteins, such as beans and peas. The animal foods may also be important sources of iron and certain vitamins.

Group 6 comprises the grains and the products made from them—such as flour, bread, and cereals—provided that they are whole-grain or enriched. The foods in this group are primarily a source of calories; but since these foods are usually consumed in considerable quantities, they become important sources of many other nutrients, particularly the B vitamins and iron.

Group 7 consists of butter, which is a natural source of vitamin A, and margarine, which has been fortified with vitamin A. These fats are concentrated sources of calories.

The relationship and balance between the foods listed in the Basic Seven Food Groups and the amounts of those nutrients recommended in the Nutrition Yardstick (Table 3) which are most frequently inadequate in our diets can be expressed in the following way:

Unless citrus fruits or tomatoes are included in the diet, it is almost impossible to obtain the recommended amounts of vitamin C. Enriched or whole-grain bread or a whole-grain cereal helps to ensure an adequate supply of thiamine as well as other vitamins and iron. A green or yellow vegetable furnishes a substantial proportion of vitamin A. If milk were the sole source of vitamin A in the diet, it would have to be consumed in exces-

Courtesy U.S. Dept. of Agriculture

Which of the Basic Seven Food Groups are represented in a substantial school lunch consisting of milk, cheese, fresh snap beans, creamed potatoes, corn bread and butter, peanut-butter cookies, and an apple? (See chart on page 31 and lists of Basic Seven Food Groups in Chapter 10.)

sively large quantities to supply the necessary amount of that nutrient. Meat is the main source of niacin; it also provides a considerable supplement of riboflavin and some thiamine. If it were the sole source of riboflavin in a diet lacking in milk, meat would have to be eaten in exceptionally large amounts. A regular and adequate supply of the principal vitamins and minerals is most readily obtained by consumption of these foods in sufficient amounts each day. Otherwise the diet must be specifically planned if it is to furnish all the necessary nutrients.

Annual food needs according to the basic seven groups. It has been estimated that if you ate sufficiently to meet the requirements of the Nutrition Yardstick you would need to consume approximately the following amounts of food annually:

100 pounds green, leafy, or yellow vegetables
100 pounds oranges or grapefruit, tomatoes, and raw green cabbage
130 pounds white potatoes and sweetpotatoes
200 additional pounds of vegetables or fruits

This farmer produces six foods—corn, cabbage, potatoes, apples, turnips, and milk. In which of the Basic Seven Food Groups does each product belong? What additional foods would he have to buy in the store to fulfill the daily nutritional needs of his family?

Courtesy U.S. Dept. of Agriculture

46–91 gallons of milk
78 pounds lean meat, poultry, or fish
30 dozen eggs
18 pounds dried beans, peas, or nuts
100 pounds whole-grain cereals and bread
50 pounds other grain (may be whole-grain products)
26 pounds butter (or margarine with vitamin A added)
26 pounds cane or sorghum sirup, or cane molasses
40 pounds sugar or honey
26 pounds lard and fat pork or bacon

When the available supply of some of these foods is inadequate, it may be necessary to make substitutions, thus altering some of these figures. Foods which can be so substituted are discussed in Chapter 10.

The Basic Seven Food Groups apply to all people. The requirements of the Nutrition Yardstick and the Basic Seven Food

Groups apply to people living in other countries as well as in the United States. The United Nations Relief and Rehabilitation Administration (UNRRA) took the view that the nutrition requirements throughout the world were about the same but that the dietary patterns which met these requirements were different.

A country, nationality, or family may eat different foods—meaning different diets. Yet most of such foods can be fitted into the Basic Seven Food Groups. Consequently, it is largely a matter of making the right selections from these foods in order to be able to meet the requirements of the Nutrition Yardstick.

Two ways to analyze a diet. Two procedures can be used in analyzing any diet, including your own, to determine how adequate it is. The quicker and simpler way is to compare the foods in your diet with the Basic Seven Food Groups, which will give you an approximate answer. The accurate, technical, but long method is to analyze the nutrient content of your diet and compare it with the amounts given in the Nutrition Yardstick, in Table 3. We shall show you in this book how to analyze your own diet by both methods.

For Review

1. What is meant by the Nutrition Yardstick?
2. What are the 10 nutrients listed in the Nutrition Yardstick?
3. For whom is the Nutrition Yardstick planned?
4. What use can you make of the Nutrition Yardstick?
5. What use does the U.S. Department of Agriculture make of the Nutrition Yardstick in relation to our annual food crops?
6. What common foods are included in each of the Basic Seven Food Groups?
7. For whom is this plan of Basic Seven Food Groups intended?
8. What is the relationship between the Nutrition Yardstick and the Basic Seven Food Groups?
9. What are some foods that are not included in any of the Basic Seven Food Groups?
10. In which of the seven food groups are our diets most frequently deficient?

For Personal Application

1. Prepare a table which might be called "A Nutrition Yardstick for My Family." Use only the information from Table 3 which applies to the particular members of your family. Questions and problems in later chapters will refer to the information which you enter in this table.
2. Prepare a check list, such as the one shown in Table 13 on page 359. Check the appropriate squares to indicate which Basic Seven Food Groups were included in each of your meals for 1 to 7 days. In which of the seven groups do you meet the recommended number of servings, as listed at the bottom of Table 13? In case you are deficient in one or more groups for a certain meal or day, what changes in your meals would improve them? Use the lists of food groups in Chapter 10 for reference.
3. Using the check list, as in item 2, examine one or more of the day's menus listed in Appendix D, pages 382 and 383. To what extent do these meals meet the recommended standards?

3

MANY AMERICAN DIETS LACK NECESSARY NUTRIENTS

> All the evidence is in agreement that deficiency states are common among the population of the United States. Most of them are not the severe acute type. Because of their slow, gradual development, their presence is commonly unsuspected. In frequency and severity they increase with age and with lowered economic level. As yet optimum nutrition throughout the nation has not been achieved; on the contrary, deficiency states are present on a large scale.
>
> THE NATIONAL RESEARCH COUNCIL[1]

You have learned that there now exists a standard—the Nutrition Yardstick—by which a diet can be measured to determine whether a person is obtaining the necessary food for health. Since such a standard has been made available, health and nutrition authorities have used it to measure individual diets and to make surveys of diets of large groups in communities and sec-

[1] *Inadequate Diets and Nutritional Deficiencies in the United States*, Bulletin No. 109, Washington, D.C., National Research Council, November, 1943.

tions of the country. Where diets have been so measured, a startling fact has become apparent—namely, that there are millions of people in the United States whose diets are not adequate or well balanced. In other words, this means that in a country with plenty of food there are millions of people who are undernourished. The many surveys made of different age levels, in different sections of the country, and of different income levels show that deficiencies in the diet are not limited to any one group at any one place, age, or level, but that the condition is universally true to some extent throughout the country.

Fortunately, most of these cases of undernourishment are not the severe, acute types, but are rather the mild, chronic forms of hidden hunger. Because of their slow, gradual development, their presence is commonly unsuspected. But they are nevertheless serious enough to show symptoms to an expert and to prevent full health of the individuals.

Surveys Made of American Diets

Some of the surveys made of American diets are presented in this chapter in order to show that food deficiencies exist among people in the United States at all levels of income, in different sections of the country, and at different age levels.

A nation-wide survey of adults. A nation-wide canvass[2] was made in 1945 of the principal foods eaten for a 24-hour period by representative adults in each of the 48 states. The following findings were reported:

46 percent had had no citrus fruits, tomatoes, or raw greens.
32 percent had not included milk or milk products.
23 percent had eaten no green or yellow vegetables.
8 percent had included no other vegetable or fruit.
9 percent had eaten no meat, fish, or poultry.
4 percent had had no whole-grain or enriched products.

There was some difference in the diets of people in different income groups. For example, those in the low-income groups

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[2] George Gallup, *The American Institute of Public Opinion*, February 15, 1945.

were more inclined to go without citrus fruits, tomatoes, and raw greens, milk and milk products, eggs, and butter or other fats than were those in the high-income levels. The greatest contrast was with regard to citrus fruits and tomatoes. Fifty-seven percent of the adults in the low-income level reported that they had not eaten any citrus fruits or tomatoes on that day, whereas 26 percent in the high-income group had neglected these foods. And 36 percent of the low-income group, as compared with 26 percent of the high-income group, reported no milk or milk products.

Surveys of school children. A nutrition survey was made of school children in one large state to determine how much of the daily food needs was being supplied by the meals eaten at home. The information was obtained for use as a basis in helping to determine how to plan the school lunches for these children.

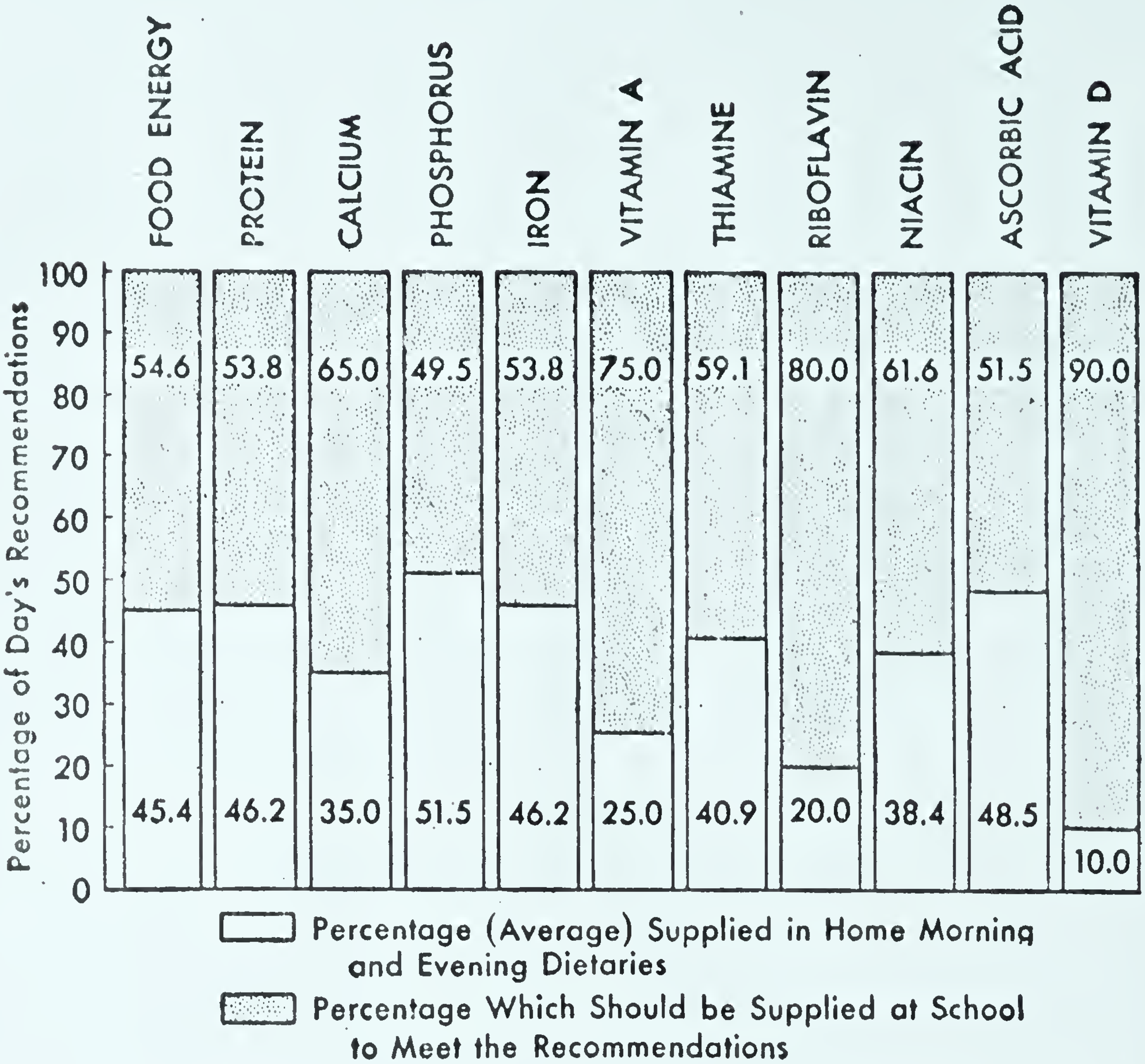
The alarming discovery from this study was that few children at any income level receive as much as two-thirds of their daily food needs in their home meals.

The chart on page 41 shows the proportion of the various nutrients provided at the morning and evening meals, including between-meal snacks, for the majority of these school children. Note in the chart what a high proportion of the food needs would have to be supplied by the school lunch if the children were to be supplied with adequate diets for the day.

Another nutrition study, made in 1948, dealt with school children in the state of New York. Three-day diet records of fourth-grade and tenth-grade pupils were analyzed to discover the amounts of protein, milk, meat, fruits, and vegetables included in the diets. It was found that elementary school children had better food habits than did high school pupils and that high school boys made a better selection of food than did high school girls. Children from high-income levels consumed more protective foods than did those from the low-income and medium-income levels. Children from New York City had better food habits than the children in the rest of the state.

If studies similar to these two were made with school children in other states, no doubt the findings would be similar.

What Young People Get Compared to What They Need



Adapted from "The Chemistry Leaflet"

Because many school children do not obtain adequate nutrients in the meals they eat at home, an effort must be made to supply them with the missing nutrients in their school lunches. The information given in this chart is based on a study made in one large state.

A survey of a high-income group. There is reason to believe that lack of income to buy food is not the chief cause of malnutrition. It has been found that even people with plenty of money do not always have adequate diets. For example, in a study[3] made of 225 individuals in the high-income level, the following percentages of people lacked these nutrients:

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[3] H. T. Kelly and Myrtle Sheppart, "A Dietary Study of Subjects from Upper Income Groups," *New England Journal of Medicine*, January, 1943, pp. 118–124.

77 percent did not have sufficient riboflavin.
76 percent did not have sufficient thiamine.
74 percent did not have sufficient calories.
46 percent did not have sufficient calcium.
40 percent did not have sufficient iron.
37 percent did not have sufficient protein.
26 percent did not have sufficient vitamin A.
13 percent did not have sufficient vitamin C.

Seven percent of the individuals consumed less than the amounts given in the Nutrition Yardstick for all of the eight food essentials listed above. In the surveyed group were nine physicians whose diets were as poor as those of the other individuals.

Studies Made to Improve American Diets

In order to show that health can be improved, even in a short time, by knowledge of nutrition and better methods of meal planning, and by more careful selection, storing, and preparing of foods, authorities have worked with groups of people over periods of time. That definite improvements in nutrition and health are possible through such methods is illustrated by the following two stories.

A study of groups of families. An interesting study of how eating and food habits can be changed and therefore how health can be improved was made with a group of families by The Pennsylvania State College and the Westinghouse Electric Corporation over a period of a year. Sixty-four families—239 people in all participated in this project. The people ranged in age from 15 days to 74 years.

Each person was given three complete medical and nutritional examinations—one at the beginning of the study, a second one after 6 months, and a third at the end of the study. More than 230 separate tests were made in these examinations. They showed how efficiently each individual made use of the vitamins and other nutrients obtained from his or her food. The tests also gave information about the condition of the bones, teeth, skin, blood, and a great deal more. In fact, these tests gave the scientists a

The American Family Now Eats

More of These Foods | Less of These

Courtesy "Life"

The average family of four eats more food today than it did 10 years ago. The increase is chiefly in such foods as vegetables, fruits, meat, eggs, milk, and breakfast cereals. Families eat less shortening, butter, tea, flour products, and potatoes.

clear picture of the nutrition rating and physical well-being of each person. When the tests were started, each person looked hale and hearty, but it was found upon physical examination that they had symptoms of malnutrition.

When the food intake was checked, it was discovered that 28 percent of the people were not getting adequate food. By further questioning it was found that little attention was paid to proper balancing of meals; that menus were planned around family likes and dislikes rather than around their individual needs; and that large amounts of vitamins were lost through improper cooking methods.

After the deficiencies in diets were discovered, each family was given a variety of daily menus of balanced diets. Definite quantities of food were prescribed according to individual needs, based on age, size, sex, activity, and physical condition, as revealed by the first series of tests.

Homemakers were taught how to cook foods to retain the greatest amount of vitamins and minerals. They were also taught how to store foods properly.

Although the people in the study ate more food when the menus were followed, the cost of the food was no greater when allowance was made for the rise in prices at the time of the study.

When the families laid aside old eating habits and took on new ones, considerable improvement was shown in their physical well-being, as proved by their medical and nutritional ratings.

The greatest improvement of any group was made by teen-age boys. Sixty percent of the boys were underweight at the start of the study whereas, at the end, 85 percent reached ideal weight. Tests at the beginning had shown that they ate better balanced meals than their teen-age sisters—the chief lack being the amount of food eaten.

The teen-age girls showed many of the faulty eating habits of their mothers. At the start of the study, 50 percent were underweight, 14 percent were far below the standard of skeletal maturity, and they consumed far too little calcium, iron, and vitamins. However, these girls made phenomenal improvement

in weight, and in other ways they showed marked improvement in regard to both eating habits and the effects of better nutrition.

At the start of the study, children under twelve years made a relatively good showing as compared with other groups. However, the early tests showed many conditions which were far from ideal. By the end of the study, both boys and girls in this age group made consistent improvement in nearly all parts of the nutritional rating.

Adult women made the poorest showing, both at the beginning and at the end of the study. Adult men made a better showing than adult women at the start of the study in everything except vitamin C. The fact that as a group they disliked raw foods, such as salads, caused men to score relatively low in this vitamin. However, they made a superior showing on nearly all parts of the nutritional rating.

All participants reported that they felt better, looked better, did not get so irritated, noticed less fatigue, and had fewer colds. Nutritious foods, properly cooked, had given definite results.

A study made in Tennessee. In Obion County, Tennessee, the land is fertile and the crops are good. The people who live there come from ancestors who trekked into this county five generations back when it was a wilderness.

This county was selected by the government for an experimental program in various aspects of family life because it is a county which depends largely upon its farms for a livelihood. It is an area where there is plenty of good, country food.

In 1940, when 1,116 children living in this county were given careful medical examinations, it was found that 841 were suffering from malnutrition because of deficient diets. These children were getting plenty of food and the type of food which they liked, but it was not the kind of food that made them grow and stay well.

As a result of the findings, many of the women enrolled in the Home Foods Supply program to learn about foods and nutrition. As a consequence, the people are now getting more adequate diets, and the children in this county have shown the effects of improved nutrition by gains in weight and strength.

Reasons for Deficiencies in American Diets

From these surveys made of different groups, ages, income levels, and kinds of people, it is apparent that great numbers of people do not eat proper food to keep healthy. We cannot help but ask why people jeopardize their own health and the health of their children in this way. Certainly they would not and do not do so purposely. Therefore, there must be other reasons which account for inadequate diets. Here we shall briefly discuss some of these reasons or factors which are most common and important.

Negative factors that affect us all. There are two things that have had a negative effect on the diets of all Americans. The first is the consumption of over-refined flour products, which practice has been going on since refining of flour was started over 100 years ago. The second is the greatly increased consumption of refined sugar. These two food practices, more than anything else, account for the lowering of the nutritional value of the American diets.

But why should the use of refined flour and sugar make such a difference? There are two principal reasons why the consumption of refined flour and sugar should be significant.

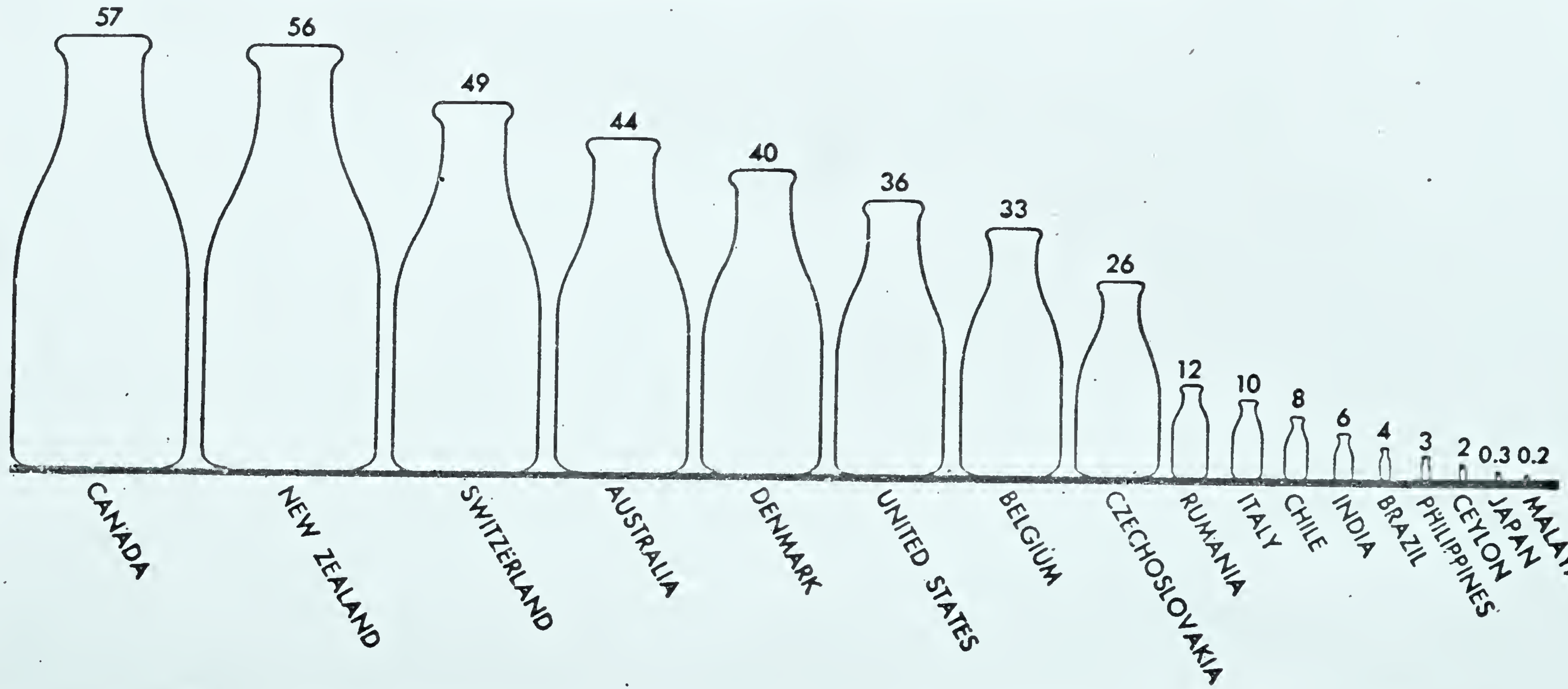
The first reason is that certain valuable nutrients are lost in the refining process. In grains, these nutrients include the B vitamins, certain other vitamins, minerals, and protein, as well as roughage. The B vitamins have been found essential to the body for proper utilization of starches and sugar, and nature has wisely provided that they be found in many of the foods, such as grains, which supply carbohydrates.

The other reason is that an increase in the consumption of refined foods reduces our consumption of the protective foods vegetables, fruits, meat, eggs, and milk.

In the early days of our country cereal grains supplied 50 to 55 percent of the calories in the average diet. Since these grains were *whole grains*, they included appreciable amounts of thiamine, iron, and other nutrients. Today, the grains are over-refined and processed.

Furthermore, refined white sugar has taken the place in our diets of nearly half of the amount of carbohydrates which used

Consumption of Milk Products in Various Countries*



Courtesy Food and Agriculture Organization of the United Nations

Note that in five countries more milk is consumed per person than in the United States.

* The numbers indicate the average number of ounces consumed per person for each day. A quart of milk contains about 32 ounces.

to come from whole-grain products. The use of sugar for food averages 85 pounds per person annually. This amount is in comparison with the 5 pounds which the Pilgrims had available as a luxury item. The 85 pounds of sugar represents 420 calories daily, or about 13 to 17 percent of the 2,500 to 3,000 calories contained in the average adult diet. Regardless of whether this sugar is from sugar cane or from sugar beets, it is for the most part highly refined.

Whether sugar is consumed straight or in food, candy, and soft drinks, it still is refined sugar which does not contain the vitamins needed by the body to make full use of it as a source of energy.

Fortunately, the enrichment of flour by the addition of three B vitamins and iron has partly made up for the nutrients removed in the process of refining grains. But even enriched flour lacks some of the nutrients which are present in the original whole grain, and not all flour is being enriched.

Nothing similar has been done to refined white sugar to make it a source of more than just calories. Consequently, since we consume such large quantities of sugar in our diets, sugar consumption is a major contributing factor in unbalancing our diets.

Lack of knowledge. A person's information and beliefs about food, diets, and nutrition are based either upon a sound knowledge of scientific facts or upon misconceptions, fads, and even superstitions.

There may be ignorance of what and how to buy, of what foods to eat and how much to consume, and of how to store and prepare food. But today no one needs to be ignorant or misinformed about these things. Scientific facts are available that should help to explode many of the erroneous beliefs about food which may have been handed down for generations in families and groups.

That such a lack of information exists was more factually determined through a survey[4] of what 5,000 individuals know

[4] H. F. Kilander, "What the Public Knows about Nutrition," *The Research Quarterly*, American Association for Health, Physical Education and Recreation, May 1944, pp. 188–197.

about foods and nutrition. A nutrition quiz was given to high school and college students, homemakers, professional people, laborers, and others. Many were also interviewed to determine the relationship between their food habits and their grades on the test.

It was found that less than half knew enough about the facts of nutrition to be able to make a wise selection of foods when they had a choice from which to make the selection, such as in a cafeteria. Even fewer individuals were sufficiently informed on foods and their nutritional value to plan or select a well-balanced meal in case that selection also meant watching the food dollar. However, the people were found to be better informed than ones similarly tested 10 years earlier, showing that progress is being made.

Habit and tradition. To a large extent habit determines what the average person and the average family eats. Most families continue to eat the same way year after year. Their breakfasts, for example, tend to be the same each day. Much of our pattern of eating is that which has been handed down to us by our parents and others before them. Girls learn to cook at home the way their mothers do, and so it is quite natural for them to cook much the same way when they set up their own homes. Boys, too, may tend to want to continue after marriage some of the food and cooking patterns practiced by their mothers.

Food preferences, methods of cooking, and table customs also follow national patterns. In this country we find many illustrations of such patterns being continued by immigrants and their descendants. There is also a national pattern in the United States, as well as patterns that are customary in various sections of the country. When it is certain that such food traditions, customs, and habits are nutritionally sound, they may well be continued. However, if the habitual food patterns do not make for a balanced diet, they ought to be improved upon or replaced. That food traditions and habits can be very strong is evident from the resistance that many people show toward desirable food changes.

Wrong attitudes. Individuals, as well as groups, may differ greatly in their attitudes toward food in general, toward certain

Scene still from the Metro-Goldwyn-Mayer picture "Dragon Seed"

The people in different countries have different foods and food habits. Yet, the people in each country can fulfill the requirements for an adequate diet by planning meals around the Basic Seven Food Groups.

specific foods, or in regard to their willingness to accept changes as the result of findings and new conditions. Some people may be indifferent to their health. Many individuals had poor training in food habits in childhood so that they now have definite likes, dislikes, tastes, and preferences, many of which are nutritionally unsound. Young people frequently have pronounced likes for sweets, soft drinks, and pastry, and equally strong dislikes for more nutritious foods. Some people do not want to try any new foods. Many homemakers lack enthusiasm for cooking at home; others have to cater to unsound whimseys of their husbands and other members of the family.

Since attitudes are acquired—that is, they are learned and not inherited—it is possible to develop desirable or undesirable attitudes about anything, including food. Therefore, where poor attitudes about food exist, it should be possible, though perhaps often difficult, to replace them with better ones; and where good

attitudes toward food already are present, they can be further strengthened, particularly through a broader understanding of facts about nutrition. In the case of very young children, it is just as easy to develop favorable attitudes as wrong attitudes, provided that parents desire to do so and are willing to improve their own attitudes and habits concerning food.

Lack of money. When people do not have enough money to buy sufficient food or the right kinds of foods, it is more difficult for them to meet the requirements for good diets, even though they know what good nutrition is. In contrast, people with adequate incomes find it easier to plan and eat balanced diets, provided that they have a knowledge of nutrition.

This was illustrated during World War II, when more people were employed and wages were relatively high. During these years the national food consumption went up along with our national income, since people bought more vegetables, fruit, meat, milk, and other foods.

It is possible for people with low incomes to eat well-balanced diets, provided that they are careful in the selection and preparation of foods. Such wise food selection requires knowledge of nutrition on the part of the person making the selection—whether in a grocery store or in a restaurant.

Lack of money, however, is not so great a factor in malnutrition and bad eating habits as is lack of knowledge about nutrition. Most surveys on food habits show that unsatisfactory eating habits and malnutrition of some degree exist even among those who can afford to eat satisfactorily.

Proper foods not available. In the United States we have not been too concerned, except in wartime, over the supply of desirable foods, because desirable foods have usually been available in most parts of our country for those who wanted them and could afford to buy them.

For many individuals, groups, and whole nations, though, this question of availability is a very serious and real problem. Many groups just have not had access to certain desirable foods; and, what is worse, in the case of some countries, there simply has not been enough of anything. Even in this country there are

individuals living in isolated regions who do not have access to needed foods. The climate may be such in some areas as not to permit the raising of certain crops. There may also arise problems because of crop failures, inadequate storage facilities, and difficulties with transportation.

Another factor of availability is that of not being able to eat what is known to be desirable because of the ignorance or indifference of someone else. A homemaker, a restaurant manager, or a storekeeper may not make the desirable foods available. For example, a local storekeeper may not keep whole-wheat bread or soybeans in stock.

In such cases other foods which can supply the same nutrients may have to be substituted. Because the Basic Seven Food Groups list so many different foods in each group, substitutions can easily be made.

Physical factors. There are some people who apparently are eating well-balanced and adequate diets but who still are malnourished. It may be that their bodies do not use the foods eaten so efficiently as is normal. It may be that some of the nutrients are not absorbed from the digestive system into the blood stream to the extent that should be the case. Some individuals find it difficult to digest certain foods which normally should not cause any trouble.

Certain other physical conditions—such as obesity, increased age, illness including infections, exposure to toxic substances, and pregnancy—may bring on special nutritional needs and problems which may be more difficult to meet.

Relative importance of factors. These several factors, or reasons for inadequate diets, largely explain why you and others eat as you do. The most common causes for inadequate diets are a lack of information about foods and nutrition and insufficient income.

The greater the knowledge of foods and nutrition, the less serious each of the other factors is likely to be. The more a person knows about this subject, the more it is possible to eat correctly even on a low food budget. Knowledge enables a person to substitute, for unavailable foods, available ones of comparable or

better food value. Knowledge of the facts of nutrition is likely to contribute to desirable attitudes. Knowledge of nutrition, finally, permits the person who needs a special diet to select better than otherwise would be possible.

These are the reasons why it is to your personal advantage and interest to become better informed on this vitally important subject of nutrition.

Positive Changes in American Diets

An interesting picture of changes for the better in our national food habits can be obtained from statistics on food consumption between 1909 and 1945 prepared by the U.S. Department of Agriculture. This improvement in our national diet reflects increased incomes, greater availability of certain foods, and more knowledge of foods and nutrition in our country.

The most notable changes in food consumption during the period 1909 to 1945 were steady increases in the per capita consumption of dairy products (excluding butter), citrus fruit, and leafy, green, and yellow vegetables, and downward trends in the consumption of potatoes and grain products.

Four times more citrus fruit was consumed in 1945 than in 1909. Fresh tomato consumption remained fairly constant from 1909 to about 1936; then it increased gradually until, in 1945, it was about a third larger than in 1909 or 1936. A definite trend is not apparent in the consumption of other vegetables.

From 1909 to 1945 there has been an increase in the per capita quantities of calcium, riboflavin, vitamin A, and ascorbic acid consumed in the United States. The greater amounts of calcium and riboflavin came from an increase in milk; the larger quantities of vitamin A and ascorbic acid came from an increase in vegetables and fruit. Because of the flour-enrichment program, grain products now furnish a much greater share of the total quantities of iron and the B vitamins than formerly.

It is hoped that the next report of this type will show even greater trends toward the use of the more nutritional foods. Your personal application of the information in the following chapters will be a step in that direction.

The United States is extremely fortunate in ranking among the first in its per capita food production. But the fact that a large proportion of the world's population is ill fed should have a sobering effect upon us. It should make us realize that we have an obligation to help relieve the suffering caused by insufficient food.

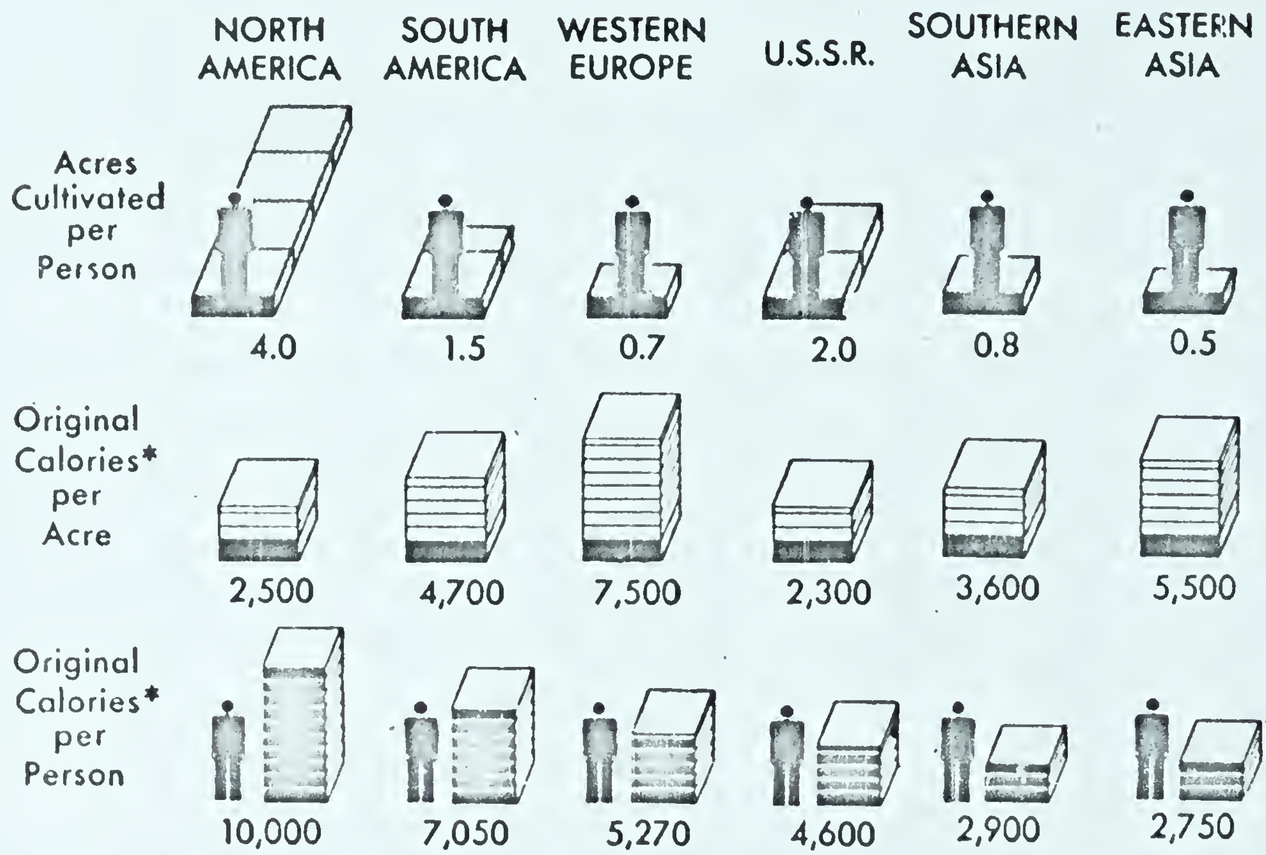
Millions of people in some countries have died from starvation in the past years. Adverse factors resulting from World War II, such as loss of livestock and equipment, crippled transportation, lack of feed, seed, and fertilizer, and a decrease in the amount of arable land, contributed enormously to the inadequate diets in many countries. Some of these same countries, as well as others, were also the unfortunate victims of natural causes of low food production, such as storms, floods, drought, and locusts.

It has been estimated that in 1650 there were 500 million people in the world. Now the population is over two billion and increasing at the rate of 20 million a year. This annual increase in population is further contributing to the problem of feeding the people of the world. Have we outgrown the possibility that world agriculture will support the world's people?

Rough estimates indicate that there are on this earth four million acres of land suitable for cultivation. This amount is about 12 percent of all the land, and upon it the world must depend for food. It allows scarcely two acres per person. In some countries there is less than one acre per person. Certain nutrition scientists say that 2½ acres of fairly productive land are needed to produce an adequate diet for one person. This figure includes land which is also needed for other human needs, such as cotton for clothing. These estimates give a partial answer to the question of whether or not the world's population can be fed adequately.

The higher level of living standards in the United States is to a large extent due to the fact that there are only 250 persons for each square mile—640 acres—of land suitable for cultivation, as compared with nearly 900 persons in Italy and more than 3,000 in Japan!

Food Produced per Person in Different Sections of the World



Courtesy "World Food Survey"

Because of the difference in population per acre, certain sections of the world have fewer calories of food per person, even though they produce more food per acre than other sections.

* "Original calories" refers to the amount produced, although not always actually used.

The Food and Agriculture Organization (FAO) of the United Nations is one of the newest of the organizations dealing with world food problems. The nations which signed the constitution of the Food and Agriculture Organization in 1945 bound themselves in the preamble to the constitution to collective action aimed at "raising levels of nutrition and standards of living of the people under their respective jurisdiction; securing improvements in the efficiency of the production and distribution of all food and agricultural products and bettering the condition of rural populations."

In 1946 the Food and Agriculture Organization issued a long-range food survey, based on data from 70 nations with nine-tenths of the world's population, and presenting, country by

country, information on average prewar food consumption, practicable nutrition targets that would raise average diet levels of ill-fed populations, and changes in production that would be required to achieve the targets.

For the United States the FAO recommended the production and consumption by 1950 of more milk, fruit, and vegetables, and less sugar. Based on a predicted 12 percent increase in population by 1950 as compared with prewar population, the goals for the United States called for 55.6 percent more milk and milk products, excluding butter, than the nation used before the war. Fruits and vegetables should jump 48.6 percent, and meat, fish, and eggs should increase 17.6 percent. With Americans averaging more than 3,000 calories in their daily diet compared with the FAO recommended minimum of 2,600, the goals outlined for the United States are aimed at a better balanced diet rather than at more food.

Foods for export purposes would be in addition to the goals listed for national consumption. Most of the foods sent to other countries are those which, like the grains, can be stored and transported long distances without spoiling. Therefore, the production of such foods in the United States is for the combined purpose of meeting national needs and export demand.

Britain, like the United States, needs more fruits, vegetables, and milk, with less sugar, according to the survey. But balancing American and British diets is a small matter compared with the fact, emphasized in the FAO survey, that "about half the world's population was seriously undernourished in the years before World War II." China and India require more of all food products. The goal for China's millions by 1960 includes a jump from 20,000 tons of milk to 1,150,000 tons, or an increase of 5,650 percent! South America will need more food of all classifications, while southeastern Europe requires increases for all foods except grains.

It will be of interest to see how near these goals are approached over the years. It is hoped that they might even be exceeded in some instances in the near future. You can help these goals to materialize.

For Review

1. What were the findings obtained through the nation-wide survey made of the eating habits of adults?
2. What are some conclusions to be drawn from the nutrition studies on school children?
3. What were some of the results of the family nutrition study?
4. How did the people in Obion County, Tennessee, solve their food problem?
5. What are the two important negative factors in the American diet that affect most of us?
6. How does our sugar consumption of today compare with that of the Pilgrims?
7. List the several reasons why there are deficiencies in American diets. Which ones of these factors can the average person control or do something about?
8. What do the reports of the Department of Agriculture indicate as to the trends in food production from a nutritional point of view?
9. How does food production in the United States compare with that of other countries?

For Personal Application

1. In Chapter 2 you compared one of your day's diets with the Basic Seven Food Groups and determined whether or not the diet was adequate in each of the groups. Carefully consider how each of the causes of dietary inadequacies is related to your own findings.
2. For each of the several stories given in this chapter, answer the following questions: What causes or factors accounted for the type of diet which each group had? If the diet was inadequate, do you think this inadequacy could have been prevented? How?
3. Read articles in magazines and newspapers telling about the food situation in other countries. Report to the class on the situation in any one country.
4. Write a story about some person which will give a picture of his or her food habits and food attitudes.
5. Make a list of foods which are more common on the market today than they were 10 to 25 years ago. No doubt you will need to ask some older member of the family for this information. Which of these new foods are of high nutritional value? Where does each belong in the Basic Seven Food Groups?

6. Conduct your own survey of the diets of several of your friends, relatives, or classmates. Compare your findings with those given in the survey described on page 39.
7. Get information about the foods eaten in another country from someone you know who was born in that country. How do these foods compare with foods eaten in America? Would the foods eaten supply the Basic Seven? If not, what is lacking?

4

PROPER NUTRITION IS NECESSARY FOR ENERGY

> There is considerable evidence, both scientific and resulting from practical experience in manufacturing industries, that the health and productivity of workers are greatly dependent upon the foods they eat.
>
> ROBERT S. GOODHART, M.D.[1]

Most of the energy on this earth is derived directly from the sun. Part of the energy from the sun may be transformed into energy of winds and water currents. The energy of winds and currents, when used to turn windmills and turbines, is transformed into other forms of energy—such as heat, light, electricity, and even sound.

When rays from the sun strike the leaves of plants directly, they set into operation a process called photosynthesis. In this process carbon dioxide from the air and water from the soil are

[1] Former Chief, Industrial Nutrition Division, U.S. Department of Agriculture.

combined into a simple form of sugar in which the energy from the sun is stored. All plants, animals, and human beings are dependent upon the process of photosynthesis for their energy needs.

For convenience in talking about the related terms energy, heat, fuel, power, and work, a unit of measurement known as the calorie is used. A calorie represents a quantity of heat, a quantity of mechanical work or power, or a quantity of stored energy which is capable of conversion into heat or mechanical work.

More specifically, *the large calorie is that amount of energy needed to raise the temperature of 1 pound of water 3.6 degrees Fahrenheit or 1 kilogram of water 1 degree centigrade.* Defined in another way, the calorie is that quantity of energy in an ideal engine necessary to perform 3,087 foot-pounds of work—the amount of energy needed to raise a 1-pound weight to a height of 3,087 feet or the amount of energy needed to raise a 3,087-pound weight to a height of 1 foot

Food as Our Source of Energy

How plants put energy into foods. The process of photosynthesis in plants is made possible by the action of the green substance in plant leaves, called chlorophyll. It is the only substance known in nature to possess the power to act as a "sunlight trap." The energy obtained when coal and oil are used for fuel was originally solar energy trapped millions of years ago by chlorophyll in plants. Like all other energy, the energy from the sun can be measured in terms of calories.

The chemical equation for the manufacture of sugar by photosynthesis is expressed as follows:

$$6CO_2 + 6H_2O + \underset{\text{(calories)}}{\text{energy}} \rightarrow C_6H_{12}O_6 + 6O_2$$

6 molecules of carbon dioxide	6 molecules of water	from sunlight	yields	1 molecule of sugar	6 molecules of oxygen

A specific illustration of this equation is the following: In 1 hour, green leaves having a total surface area of 15 square yards

can use (1) the carbon dioxide gas in 37,500 quarts of air, (2) 0.6 ounce of water, and (3) 113 calories of energy contained in the sun's rays to make (4) 1 ounce of sugar containing 113 calories with (5) 1.1 ounces of oxygen given off.

From the simple form of sugar obtained through photosynthesis, plants build up three complex forms of stored energy: (1) carbohydrates, such as starch, (2) fats, and (3) proteins. These forms of stored energy can be used as a source of fuel to run either the human machine or a man-made machine.

In man the energy derived from food containing this stored energy is used in three principal ways: (1) for maintaining the life processes in all the cells, (2) for contracting muscles in physical activity, and (3) for maintaining the normal temperature of the body.

Let us look at our energy needs and uses in relation to the amount of energy coming from the sun.[2]

The total amount of energy that the earth intercepts from the sun in radiant heat is so enormous that it is difficult to comprehend. Therefore, we shall consider the amount of solar energy reaching only a single acre of land rather than the amount falling on the whole earth. An acre is roughly a square of land 200 feet on a side, or a little less than the length of a city block, with an area of about 40,000 square feet. In most parts of the United States the solar energy averages more than 500 calories each day per square foot. Since each of the 40,000 square feet in an acre receives 500 calories daily, the whole acre receives 20 million calories of energy daily.

In the United States there are nearly two billion acres of land, or an average of about 14 acres per person. Theoretically, then, the average number of calories of sunlight available per day per person is 280 million. How does this amount compare with the amount which each person *uses* for food, heat, and power?

Breaking down the total number of calories used for food, heat, and power in the United States in one year—1946—we have the

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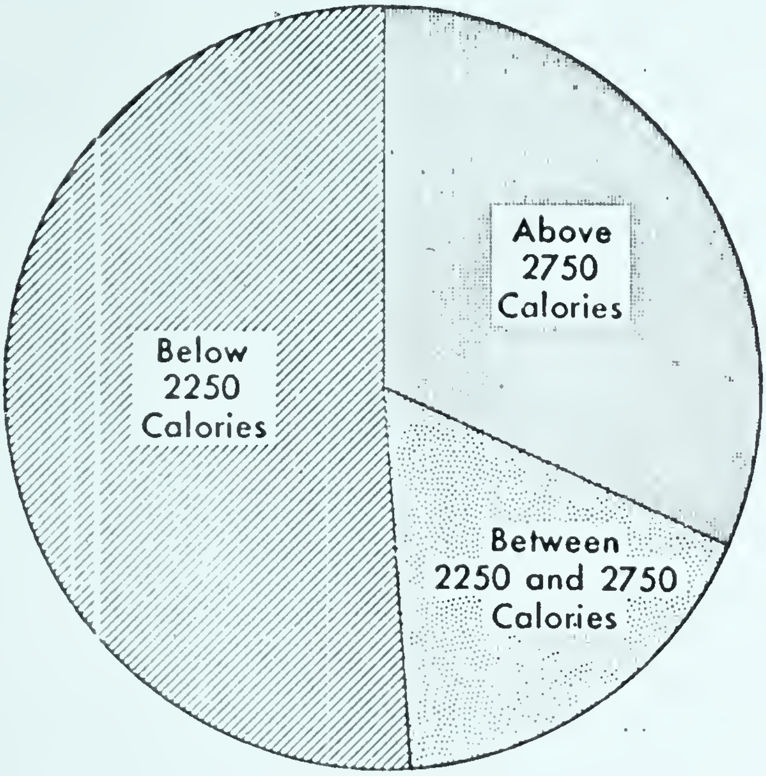
[2] Adapted from Farrington Daniels, "Solar Energy," *Science*, Vol. 109, January 21, 1949, pp. 51, 53, 54.

Calorie Consumption of World's Population



Since 2,550 to 2,650 calories are considered the average minimum amount for a person each day, it will be seen from the figures in this chart that most of the people in the world are not getting enough calories—that is, the necessary amount of food energy—in their diets.

CALORIES PER HEAD PER DAY

Courtesy "World Food Survey"

following average figures for the number of calories used by each person per day from these sources:

Food	3,000 cal
Coal	75,000 cal
Oil	50,000 cal
Natural gas	21,000 cal
Total per person	149,000 cal

When this total, of approximately 150 thousand calories used daily per person, is compared with the total of 280 million calories available from the sun, we see that the sun supplies to the United States about two thousand times as much energy as is now used. Actually the unused energy from the sun is even greater than this because most of the energy used today does not come from the daily supply of solar energy but from the solar energy stored up from bygone ages.

How the body uses food for energy. If an ounce of sugar is burned as fuel, the 113 calories of stored energy which it contains will be released in the form of heat. When a person eats an

ounce of sugar, the 113 calories of stored energy are released to his muscles or other body tissues for performing work and supplying heat to the body.

Respiration is the process of making use of the energy from food in the human body. It is the direct opposite of the process of photosynthesis. Therefore, the chemical equation for respiration is the reverse of the one for photosynthesis. (See the equation on page 60.)

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy (calories)}$$

1 molecule of sugar	6 molecules of oxygen	yields	6 molecules of carbon dioxide	6 molecules of water

As an illustration, when our body (1) burns, or oxidizes, 1 ounce of sugar with (2) our lungs supplying 1.1 ounces of oxygen, the sugar is transformed into (3) 2.2 ounces of carbon dioxide gas, which is exhaled from the lungs, (4) 0.6 ounce of water, and (5) the 113 calories of energy. The 1.1 ounces of oxygen is the weight of 12 quarts of gaseous oxygen, or the amount in 60 quarts of air.

Energy not only is used in our bodies for activity but is present in the form of sugar in all the cells. Sugar is most abundant in the cells of our muscles because muscular activity requires so much energy.

How Energy Needs Are Measured

There are two ways of determining the number of calories which you need daily for the amount of energy you use.

By watching your weight. The first method of determining the number of calories you need daily is to watch your weight. If your weight stays the same and you are in good health, you probably are eating about as many calories of food as your body needs and uses.

If you are overweight, it is a sign that you are getting more calories than you need because, when you regularly eat more energy foods—such as fats, starches, and sugar—than you

actually need, the extra food tends to collect as surplus fat in your body. If you are underweight, you are probably eating less food than you need, and your body is drawing upon its reserves.

Watching your weight gives only an approximate answer to the question of whether or not you are getting enough or too many calories. It should not be relied upon as an accurate index of one's nutritional condition, as explained on page 230. The relation of food to body weight is discussed in detail in Chapter 14.

By a metabolism test. The second method of determining the number of calories which you require is by means of the metabolism test. In a metabolism test an instrument called the calorimeter is used to measure accurately and quickly the amount of energy used by the body.

The calorimeter works on the principle shown in the chemical equation for respiration—that is, the amount of carbon dioxide exhaled, or the amount of oxygen inhaled, can be used as a quantitative measure of the amount of sugar used by the body. Knowing the amount of sugar consumed, the number of calories supplied by the sugar can readily be calculated. This is how the information in Table 4 in this chapter was obtained.

The total amount of energy which the body consumes during a 24-hour period is determined by two kinds of metabolism tests: (1) basal and (2) general.

Basal metabolism. Basal metabolism represents that amount of energy required to maintain the body functions which continue in operation when the body is at complete rest but not asleep. These functions include circulation, breathing, digestion, the maintenance of the normal temperature of the body, and the activity of the glands.

In order to take a basal metabolism test, a person should eat no food within the previous 12 to 18 hours so that the muscles of digestion will not be too active. He should have no exercise for an hour or so before the test. He should be as near to mental ease and physical relaxation as possible.

Normal basal metabolism is given a value of 1.0, which is equivalent to about 1 calorie for every 2.2 pounds of body weight

Courtesy Colby Junior College

A basal metabolism test (*top*) is given in order to determine how much energy is expended by a person in a completely relaxed condition—that is, with the least possible exertion of energy. In a general metabolism test (*right*) the amount of energy expended during activity is determined.

Courtesy University of Illinois

per hour. For one day, or 24 hours, this amounts to about 10 calories for each pound of body weight.

A man weighing 154 pounds with a normal basal metabolism rate is consuming 70 calories per hour. For a 24-hour period this will amount to about 1,630 calories. The reason it isn't 1,680 calories, or 24 times 70, is that some allowance must be made for the slight decrease in the metabolic rate during sleep. Remember that this figure represents only the basal metabolism—the amount needed merely to stay alive for 24 hours. It does not include the additional energy consumption arising from the use of the voluntary muscles.

An individual whose basal metabolism is higher than 1.0 may have an overactive thyroid gland. Such an individual is burning up energy faster than is normal, and he is likely to be thin and high-strung. People with a basal metabolism rate lower than 1.0 are likely to be overweight, since they do not consume energy so fast as normal individuals.

General metabolism. In addition to the amount of energy, or calories, needed for merely maintaining the body functions, we of course need energy, or calories, for our various daily activities. Such activities vary greatly among people, and therefore their calorie needs to provide energy will vary greatly. The total amount of energy required by a person above his basal metabolism needs for carrying out his daily activities is called general metabolism. The basal metabolism needs for two people of the same weight and age should be approximately the same, but the general metabolism needs will vary according to their individual activities.

Any movement of the body, regardless of how slight, requires an expenditure of energy—a using up of calories. Table 4 gives the relative energy expenditures for different types of work and various daily activities.

Sleep requires less energy than that of basal metabolism and has a value of 0.91. This means that you consume only 91 percent as many calories per hour when you are sleeping as when you are awake but at complete rest.

TABLE 4
Energy Expended for Different Activities*

Form of activity	Calories per hour		
	For 154-lb man (70 kg)	Per lb	Per kg
Sleeping	65	0.43	0.93
Basal metabolism	70	0.46	1.00
Awake lying still	77	0.50	1.10
Sitting at rest	100	0.65	1.43
Reading aloud	105	0.69	1.50
Standing relaxed	105	0.69	1.50
Hand sewing	111	0.72	1.59
Standing at attention	115	0.74	1.63
Knitting (23 stitches per minute on sweater)	116	0.75	1.66
Dressing and undressing	118	0.77	1.69
Singing	122	0.79	1.74
Tailoring	135	0.88	1.93
Typewriting rapidly	140	0.91	2.00
Ironing (with 5-lb iron)	144	0.93	2.06
Dishwashing (plates, bowls, cups, and saucers)	144	0.93	2.06
Sweeping bare floor (38 strokes per minute)	169	1.09	2.41
Bookbinding	170	1.10	2.43
Light exercise	170	1.10	2.43
Shoemaking	180	1.17	2.57
Walking slowly (2.6 miles per hour)	200	1.30	2.86
Carpentry, metalworking, industrial painting	240	1.56	3.43
Active exercise	290	1.88	4.14
Walking moderately fast (3.75 miles per hour)	300	1.95	4.28
Walking downstairs	364	2.36	5.20
Stoneworking	400	2.60	5.71
Severe exercise	450	2.92	6.43
Sawing wood	480	3.12	6.86
Swimming	500	3.25	7.14
Running (5.3 miles per hour)	570	3.70	8.14
Very severe exercise	600	3.90	8.57
Walking very fast (5.3 miles per hour)	650	4.22	9.28
Walking upstairs	1,100	7.18	15.8

* Adapted from H. C. Sherman, *The Chemistry of Food and Nutrition*, The Macmillan Company, New York, 1946, 7th revised edition, p. 189.

Any kind of exertion—no matter how light and whether it is work or play—requires an expenditure of energy and therefore the using up of calories. Approximate calorie needs per hour for the activities shown in these pages are given for a person weighing 154 pounds.

Courtesy U.S. Dept. of Agriculture

Sitting down playing a quiet game: 100 calories

Courtesy American Youth Hostels, Inc.

Singing: 120 calories

Courtesy Hume-Fogg Technical and Vocational High School, Nashville, Tenn.

Typewriting: 140 calories

The exact amount of energy expended, and therefore the number of calories needed, will vary according to the size of the individual and the intensity with which the activity is carried on. Compare the calorie needs for the activities shown on this page with the calorie needs of those pictured on the opposite page.

Courtesy Hume-Fogg Technical and Vocational High School, Nashville, Tenn.

Cheerleading: 170 calories

Harold M. Lambert from Frederic Lewis

Baseball: 300 calories

Courtesy Police Athletic League

Basketball: 500–600 calories

It has been estimated that an average-sized man at rest gives off as much energy in the form of heat as a 60-watt electric bulb or an alcohol-lamp flame about 1 inch in height. In contrast, a man exercising strenuously gives off heat equal to 10 such lamps, and so his energy needs will be that much greater.

Even sitting at ease requires about 40 percent more energy than being completely relaxed, or lying down. Fast walking consumes four to eight times as much energy. If you are performing very severe exercise, such as fast running, the rate of energy consumption may go as high as twenty-nine times that of complete rest. This rate is so high that it can be maintained only for very short periods of time. A hundred-yard dash may be run at a much higher rate of speed because the speed is maintained only for a few seconds.

An active high school boy will need up to 3,800 calories a day, whereas a girl of the same age needs about 2,400 calories. The over-all energy requirements for men may vary from 2,000 to 2,400 calories for a shoemaker to over 5,000 for a lumberman. A moderately active woman needs about 2,500 calories and a very active one 3,000 calories a day. Refer again to the Nutrition Yardstick on page 26 and study the energy needs listed there for individuals of different ages, activities, and sex.

The probable energy requirements of a 154-pound individual doing physical work may be calculated as follows:

8 hours of sleep (65 cal per hour)	520 cal
3 hours of light exercise, such as going to and from work (170 cal per hour)	510 cal
8 hours of carpentry work (240 cal per hour)	1,920 cal
5 hours sitting at rest (100 cal per hour)	500 cal
Total needed for the day	3,450 cal

One of the most vigorous activities in the army is a field march with rifle and heavy pack. A soldier of 150 pounds engaged in such activity for 50 minutes with 10 minutes of rest will expend approximately 455 calories per hour. About 4,000 to 4,800 calories are used up by a soldier in the average day of military activities.

It is an interesting fact that well-trained muscles are more economical in their use of energy. A person with untrained and poorly conditioned muscles who takes up sports or engages in physical work will at first use more energy and therefore need more calories in his diet. After his muscles have developed and have become better trained, this same individual is able to perform the same or even greater amounts of work on fewer calories.

Exercises of endurance, such as walking, enable the human body to perform great amounts of work at the least expenditure of muscular energy or effort as compared with exercises of speed, such as fast running, and of strength, such as weight-lifting.

Exposure to cold raises our need for calories just as exercise does. A cold shower, for example, sets the muscles of the body into involuntary action. Their tonicity is increased and maintained for some time after the shower is taken. Consequently, energy is used up during this period, as is evidenced by the warm feeling which often follows a cold shower or bath. The body is generating heat by this procedure in an effort to maintain its normal temperature. Thin people—especially children—will be less able to put on weight when allowed to stay in cold water too long, as for instance in swimming.

Exposure to cold by wearing scant clothing or exposing the skin to air and wind even in warm weather also raises the metabolic rate. In its severe forms, it results in shivering, which might be called "involuntary exercise," the purpose of which is to produce heat for the body. Nature attempts to compensate for the greater need for calories in cold weather by stepping up our appetites.

The foods which supply your needs for energy will be discussed in the next chapter.

For Review

1. In what three forms do plants store up food as a source of energy for man?
2. What are the three principal ways in which food energy is used in our bodies?
3. What is a calorie?

4. Explain photosynthesis.
5. What is respiration?
6. What is a calorimeter?
7. What is the difference between basal metabolism and general metabolism?
8. What are the comparative energy needs, as expressed in calories, by sex, age, and degree of physical activity as given in the Nutrition Yardstick?
9. Name some activities which require large amounts of energy.
10. Name other activities which require relatively less energy.

For Personal Application

In order to obtain the daily energy requirements for people who weigh more or less than 154 pounds, the calorie requirements per pound (see Table 4) must be estimated and then multiplied by the person's normal weight. The problem on page 70 may be worked by this method as follows:

8 hours of sleep (0.43 cal per lb)	3.44 cal
3 hours of light exercise, such as going to and from work (1.10 cal per lb)	3.30 cal
8 hours of carpentry work (1.56 cal per lb)	12.48 cal
5 hours sitting at rest (0.65 cal per lb)	3.25 cal
Total per pound for 24 hours	22.47 cal

Next, multiply the 22.47 calories by the number of pounds that the person weighs, which in this case is 154 pounds. *Answer:* 3,460.38 calories.

1. Figure your energy, or calorie, needs for your own weight, assuming that you spend 24 hours in the same manner as stated in the above problem. (*Note:* Overweight individuals should use their theoretically ideal weights, as given in the tables in Appendix C.)
2. Analyze your own typical day and then estimate your calorie needs. Do the same for other days that are different in some way.
3. What are the total calorie needs of a 165-pound athlete who uses his 24-hour day as follows: sleep, 9 hours; dressing and undressing, 1 hour; sitting at school and at studies, 8 hours; standing relaxed, 2 hours; light exercise, 1 hour; severe exercise (football), 1 hour; walking very fast (5.3 miles per hour), 1 hour; typewriting, 1 hour?

4. Estimate the total calorie needs for a girl weighing 115 pounds whose day is as follows: sleep, 8 hours; lying awake in bed, 5 hours; type-writing rapidly, 6 hours; standing relaxed, 2 hours; knitting, 3 hours.
5. Estimate the total calorie needs for a 160-pound office man whose day is as follows: sleep, 7 hours; dressing and undressing, 1 hour; standing relaxed, 3 hours; walking slowly (2.6 miles per hour), 1 hour; sitting at the office and at home, 11 hours; reading aloud, 1 hour.
6. Estimate the total calorie needs for a 140-pound homemaker who spends her day as follows: sleep, 8 hours; dressing and undressing, 1 hour; dishwashing, 1 hour; sweeping the floor, 1 hour; hand sewing, 5 hours; ironing, 2 hours; light exercise, 4 hours; sitting at rest, 2 hours.
7. Estimate what your own calorie needs would be if you spent the day as indicated in any one of the problems given in 3, 4, 5, or 6.

5

CARBOHYDRATES, FATS, AND PROTEINS SUPPLY ENERGY

> Call it malnutrition, call it undernourishment, call it dietary deficiency or what you will—when men and women and children fail to eat the foods that give them full life and vigor, they are in fact starving.
>
> M. L. Wilson[1]

Of the several classes of nutrients, three are sources of energy—calories—namely, carbohydrates, fats, and proteins, as shown in Table 2 on page 14. The main contribution of proteins to the diet is, however, for body growth and repair, with the supplying of energy as a secondary function.

Carbohydrates and proteins supply the same number of calories, or the same amount of energy, for equal weights. Fat is the most concentrated form of food energy, since it has over twice as many calories for the same weight as either of the other two sources.

[1] Chairman of the National Nutrition Advisory Committee and Director of the Extension Service, U.S. Department of Agriculture.

Source	Calories per gram	Calories per ounce
Carbohydrates.	4	115
Fats.	9	255
Proteins.	4	115

We shall first consider carbohydrates and fats—our main sources of energy. Proteins will be discussed separately in the next chapter because they have the additional functions of body growth and tissue repair which need to be given special consideration. Proteins are expensive sources of energy, whereas carbohydrates and fats are the more economical energy foods.

The Place of Carbohydrates in the Diet

There are several groups of carbohydrates which are included in the food we eat. The most common groups are the sugars and the starches. The carbohydrates are our most abundant and economical sources of energy.

The groups of carbohydrates. Chemically, all carbohydrates contain carbon, hydrogen, and oxygen in the proportion of two atoms of hydrogen to one each of oxygen and carbon. Weight for weight, all carbohydrates have equal calorie value. The more common types of carbohydrates are here discussed.

The sugars. By photosynthesis the green leaf builds a simple type of sugar which has the chemical formula $C_6H_{12}O_6$. There are several kinds of simple sugars, however, which may be formed, but each has the same chemical formula. Two of these sugars—dextrose, sometimes called glucose, and levulose, also called fructose—are simple sugars that can be absorbed directly from the intestine into the blood stream without any further change.

Other sugars formed are called "double sugars" because they are the result of a combination of two simple sugars with one molecule of water pulled out. The chemical formula for double sugars is $C_{12}H_{22}O_{11}$. Sucrose, which is the technical name for cane sugar and the sugar in certain fruits, such as oranges, bananas, and grapes; maltose, which is the sugar found in grains;

and lactose in milk are all examples of double sugars. In the process of digestion the body breaks down the double sugars into simple sugars.

Diabetics, who must carefully count their carbohydrate calories, sometimes use saccharin in place of sugar because, while it is very sweet, saccharin is not a carbohydrate and has no energy or other food value.

The starches and related carbohydrates. The next group of carbohydrates includes those which are made up of many simple sugar units. They are written $(C_6H_{10}O_5)^n$ with *n* representing from 7 to 200 simple sugar units, depending upon what specific carbohydrate it is. These carbohydrates—called polysaccharides—are changed by digestion into simple sugars before being absorbed from the intestine.

Starch is the best known carbohydrate in this group. It differs from the sugars in that it is not soluble in water. Because starch is not soluble in water it can be stored in the seeds and tubers of plants.

During the ripening process in some plants, as, for example, the apple and the banana, starch is changed into simple sugars. Therefore these fruits have a sweet taste when ripe. The reverse process occurs in the growth of peas and corn when sugar is converted into starch. Consequently, they lose most of their sweet flavor as they mature and ripen.

Glycogen, another carbohydrate in this group, is built up out of glucose. It is sometimes called animal starch, since it is the form of carbohydrate which is stored in animals. Glycogen is found principally in the liver and the muscles. The body has the ability to convert the glycogen back into glucose as it is needed.

Dextrin is a form of carbohydrate resulting from a partial breakdown of starch.

Amount of carbohydrates needed. The amount of carbohydrates that should be included in the diet is determined by the energy needs of the individual, as discussed in Chapter 4, and by the number of calories being furnished by fats and proteins. Ordinarily, the greater proportion of the day's sources of calories should come from carbohydrates rather than from fats and pro-

Courtesy Caterpillar Tractor Co.

Wheat is our country's principal source of food energy, or calories. For most of the world's population the energy source is rice. In some countries it may be other grains, such as corn or rye.

teins. The relative importance of these three sources of calories will be better understood after the rest of this chapter has been read.

Sources of carbohydrates. The principal sources of carbohydrates are cereals, such as bread and other flour products and breakfast foods. Other sources are the root vegetables, like carrots and potatoes, sweet fruits, honey, sugar, and candy. Refined sugar is a pure form of carbohydrate. Groups 3 and 6 of the Basic Seven Food Groups (see page 31) include the foods that are highest in carbohydrates.

The best food sources of carbohydrates are those which also contain fair amounts of vitamins and minerals as compared with the refined forms of carbohydrates. For example, whole-grain cereals are more nutritious than refined cereals. The potato is high in starch and also contains iron and vitamin C.

Courtesy U.S. Dept. of Agriculture

Although vegetables are principally known for their rich vitamin and mineral content, they also supply a fair amount of calories.

Cellulose. Another type of carbohydrate, called cellulose, has no energy value to man but is very necessary in the diet for another reason. Therefore, it is here discussed separately.

Cellulose has a chemical formula similar to starch. It makes up the skeletal and supporting structure of plant cells. When eaten as a part of mature plants, cellulose is quite resistant to the action of our digestive enzymes and therefore passes through the digestive system unchanged. Consequently, cellulose gives bulk to the food eaten and thereby helps with the peristaltic action of the stomach and the intestines. For this reason a certain amount of cellulose is needed in our daily diet to aid in the elimination of body waste.

Many animals are able to digest cellulose and thereby derive energy from this substance. Cows, for example, can convert the cellulose in grass into forms of carbohydrates which man is able to digest.

During World War II Sweden developed a process whereby digestible carbohydrates could be obtained from wood pulp, which is a form of cellulose.

Good sources of cellulose are whole-grain cereals, vegetables, and fruits. Refined foods, such as sugar, white flour, and products made from white flour, are very low in cellulose.

Cellulose is sometimes referred to as roughage or bulk, and these three terms will be used interchangeably in this book. The body's need for bulk and roughage is discussed on page 221. Hereafter, when the term carbohydrates is used in this book, it will refer to the digestible forms, such as starches and sugars, and not to cellulose.

The Contribution of Fats to the Diet

Many people have erroneous ideas about fats, and consequently fats often are not given a correct place in the diet. But fats make a definite contribution to the diet—especially the diets of young people.

Fats are made up of the same chemical elements as carbohydrates but in different amounts. They contain carbon, hydrogen, and oxygen, but less oxygen and more carbon than carbohydrates. This difference makes fat a more concentrated fuel, which requires more oxygen when it burns, or oxidizes, in the body than do the carbohydrates.

Oils are simply fats with a lower melting point, making them liquid at room temperature. Oils have the same nutritional value as fats; therefore, whatever is said about fats is also true of oils.

The food value of fats. Fats contribute 2¼ times as many calories per pound as do carbohydrates or proteins. Pure fats, such as lard, and fatty foods, such as cream, peanut butter, and pork, consequently are our most concentrated sources of energy. For this reason they are especially needed by growing young people and individuals performing heavy physical work. If it were not for the fats, these people would have to consume unduly large volumes of carbohydrate foods to supply the required amounts of calories.

Perhaps the most important reason for having some fat in our diet is that fats usually carry certain vitamins with them. Vitamin A is found in butter, cream, and fortified margarine. Vitamin D is found in the fats of some foods—fish, for instance. Fish-liver oils are good sources of both vitamins A and D.

Some fats also contribute appreciable amounts of the essential

Courtesy Food and Drug Administration

Chemists determine the percentage of butterfat in our milk. The price paid a farmer by a dairy for his milk is based on the amount of butterfat in the milk.

fatty acids which are necessary to body growth and the health of the skin.

Fats are appetizing. They give richness and flavor to many foods that otherwise would not be so tasty.

Fats have what is known as staying power. There is a prolonged feeling of satisfaction or fullness after eating a meal containing fat because fatty foods are digested more slowly than proteins or carbohydrates. Too much fat, however, will retard digestion more than may be desirable.

A certain amount of reserve fat is needed by the body to serve as insulation against heat loss and as a cushion for certain body organs. Fat which is eaten in excess of body needs contributes to the surplus of energy stored by the body as reserve food in the form of human fat. Human fat is also formed by excess amounts of carbohydrates and proteins which are converted into fat before being stored.

Amount of fat needed in the diet. It has been found desirable generally to have about 25 percent of the day's total calories sup-

plied by fats. For those who are reducing, the percentage of fat should be lowered; but other foods which supply vitamins A and D should be eaten in sufficient amounts as a substitute source for these vitamins. Individuals who are attempting to gain weight may need to include a higher percentage of fat.

Sources of fats. The richest sources of fats are fat meats, butter, cream, lard, mayonnaise, shortening, and egg yolks among the animal sources, and vegetable oils, nuts, and soybeans from plant sources. The only important difference between animal and vegetable fats is that many, but not all, animal fats contain vitamins A and D, whereas plant sources do not contain these vitamins unless they have been fortified—that is, had vitamins added—as in the case of margarine. This fact needs to be considered in planning meals, especially those for children.

Study the column labeled "Fat" in Table 10 in Appendix A and note that many foods which ordinarily are not thought of as being fats or oils contain appreciable amounts of this nutrient.

For Review

1. Which three food classes or nutrient groups supply calories?
2. How do the various sources of energy compare in calorie value?
3. Name several different groups or types of carbohydrates.
4. How does cellulose differ from other carbohydrates?
5. Give several reasons why fat in reasonable quantities is desirable in one's diet.
6. Name common foods which are high in carbohydrates; high in fats.
7. Name common foods which are high in total calories; medium in total calories; low in calories.

For Personal Application

1. Analyze a single meal for its calorie content, using Table 10 in Appendix A for your information.
2. Analyze one or more of your day's diets (originally requested in Chapter 1) for their calorie content. How do the amounts compare with the Nutrition Yardstick for you?

3. List five or more foods high in calories furnished largely or entirely by carbohydrates.
4. List five or more foods high in calories furnished mainly by fat.
5. List five or more foods which are very low in calories. Are these foods good sources of vitamins and minerals?

6

THERE IS A VARIETY OF PROTEINS IN OUR FOODS

> Food is eaten for enjoyment, for emotional release, for social prestige, and for attention, adverse or otherwise. Food is refused because of such unconscious emotions as the pleasure of paining others and showing self-assertion. When a person refuses crab, cabbage, or codfish or scorns beans, bananas, or broccoli, he is not showing a connoisseur's discrimination but evidencing an unhappy soul.
>
> JENNIE I. ROWNTREE[1]

There are many kinds of proteins in foods and in our bodies. Each protein is made up of amino acids, which are often called "the building blocks of proteins." These amino acids all contain carbon, oxygen, and hydrogen, as do the fats and carbohydrates, but in addition, all amino acids contain nitrogen, and some of them also have sulfur and phosphorus.

[1] From "The Human Factor in Nutrition Study," *Journal of Home Economics*, October, 1949. Dr. Rowntree is Director of the School of Home Economics at the University of Washington.

Altogether the body requires 22 amino acids in order to build up its own great variety of proteins found in its various tissues. According to present knowledge, the body apparently can manufacture all except 8 to 10 of these 22 amino acids. These 10 must be supplied through our diet and are, therefore, called "essential amino acids."

A protein which contains all of these 10 essential amino acids in appreciable amounts is called a "high-quality protein." It is also known as a "complete" or "adequate" protein, as compared with the "incomplete" protein which is low or lacking in one or more of the essential amino acids. Thus, by eating complete proteins you are supplying yourself with all of the 10 essential amino acids. Complete proteins are obtained largely from animal sources. Plant proteins usually are incomplete and therefore deficient in one or more essential amino acids.

Man and animals, through digestion, break down the protein which they obtain in their food into amino acids and then recombine these amino acids as needed to produce their characteristic kinds of protein — the myosin of muscle, hemoglobin of blood, the fibrein of silk, or the keratin of wool, horn, feathers, and hair.

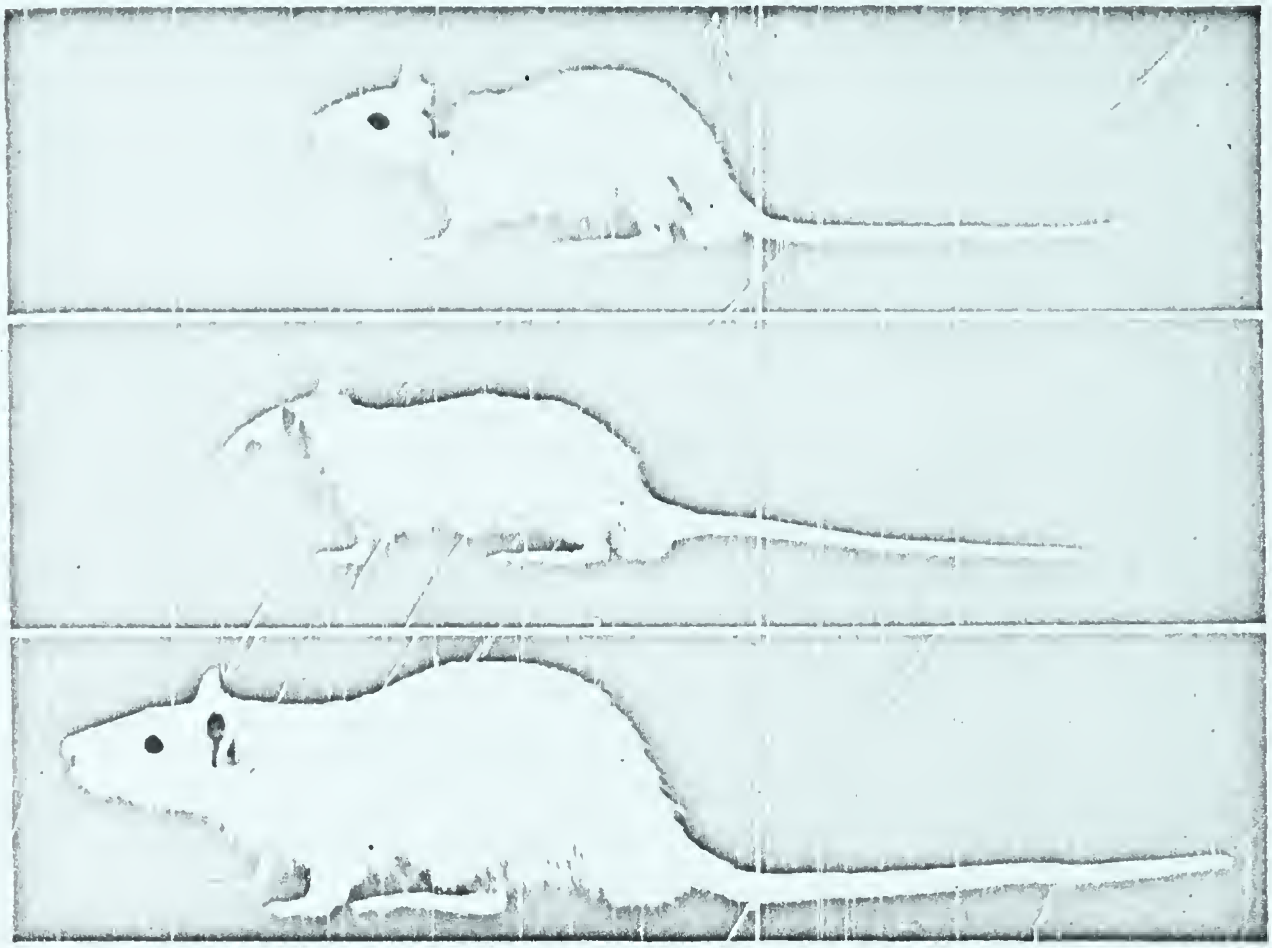
The functions of proteins. Proteins meet all three of the general functions of food, as indicated in Table 2 on page 14, which are as follows:

To build and renew body tissue. Muscles, skin, nerves, glands, blood, hair, and nails are made of protein. Nothing else can take the place of protein in building body tissue or in the repair of such tissue.

It is especially essential that children be supplied with high-quality protein in order to aid in their growth. Insufficient protein will lead to subnormal growth.

Even when the period of growth has been completed, it is necessary to supply the body with protein to build new cells for the old ones that are continuously being worn out. Protein is further needed by adults under certain special circumstances — such as pregnancy and lactation, when muscles are being rebuilt following a wasting illness or prolonged fasting, and when muscles are being enlarged through exercise.

Protein Made the Difference in These Three Rats



Courtesy Bureau of Human Nutrition and Home Economics

The first rat was given foods that furnished good-quality protein but not enough. It weighs 70 grams. The second rat ate foods that furnished plenty of protein but not in the right combination to give good quality. It weighs 65 grams. The third rat had plenty of good-quality protein from a variety of foods. It has good fur, a well-shaped body, and weighs 193 grams.

To help regulate body processes. Certain of the hormones and enzymes which are used in regulating the body functions are partly or largely made up of protein material, and therefore an adequate supply of protein is essential to regulate the body processes.

A deficiency of proteins retards the formation of hemoglobin in the red cells of the blood so that anemia may develop. These cells are necessary for carrying oxygen from our lungs to all parts of the body.

Another function of protein is to help control the level of acidity of the blood. When we exercise, the muscles produce lactic acid. Certain proteins in the muscle cells combine with the lactic acid to help in keeping down the acidity of the blood.

Minerals also assist in this protection against acidity, which is known as a buffer action.

To supply energy for bodily activity. Proteins can be burned by the body to supply heat and energy, but they are an expensive and wasteful source of fuel as long as carbohydrates and fats are available.

However, the body will use protein as a source of energy if sufficient amounts of carbohydrates and fats are not eaten to meet the individual's heat and energy requirements. When the body must use protein as a source of energy, the protein is not available for more important functions, such as growth of the body and repair of tissue. This may contribute to such conditions as stunted growth in children.

In cases of starvation, the protein tissues in the body, such as the muscles, serve as the main source of energy so long as they hold out.

When protein is eaten in excess of the individual's needs for the functions of building and repairing of tissue and regulating body processes, the excess protein loses its nitrogen and is transformed into body fat if it is not needed as an immediate source of calories.

The protein needs of different groups. The amounts of protein needed for individuals of different ages, sex, and activity are given in Table 3 on page 26. The protein needs vary greatly for children and adults.

For children and youth. The protein requirement of the growing child is higher in proportion to its body weight than that of the adult because protein is needed for growth. Experiments conducted on growing animals show that they become retarded and stunted in growth when their protein diet is very low in amount and poor in quality.

Infants need a minimum of 3 grams, or 0.1 ounce, of protein for every kilogram, or 2.2 pounds, of body weight. An infant weighing 5 kilograms, or 11 pounds, should, accordingly, have 15 grams, or 0.5 ounce, of protein daily.

The amount of protein needed by children increases until about the age of fifteen for girls and twenty for boys. At these ages

Protein Equivalents

Courtesy National Dairy Council

These foods in amounts indicated furnish the same amount of protein. Which foods seem to have the highest protein content? Which the lowest?

girls need approximately 80 grams, 2⅔ ounces, and boys need 100 grams, 3½ ounces, daily.

Another way of calculating the protein needs for children and youth is to plan to have from 10 to 15 percent of the daily calorie needs supplied in the form of protein. The upper figure will supply a safe margin. Another important rule to follow is that *at least one-third* of the protein should be *from animal sources*, such as meat, fish, poultry, milk, cheese, and eggs. Infants should have two-thirds of their protein from animal sources.

For adults. The adult requirement of protein for maintenance and repair of body tissue is supplied by a diet in which protein furnishes 10 percent of the total calories. This percentage is adequate, provided that the rest of the diet supplies sufficient food for energy and that not less than one-third of the protein is of high quality.

During pregnancy and lactation it is recommended that two-thirds of the daily protein needs be obtained from animal sources.

The recommended daily amount of protein for adults is 1 gram per kilogram of normal body weight. A man weighing 70 kilograms, or 154 pounds, therefore needs 70 grams, or about $2\frac{1}{2}$ ounces, of protein. A high school boy of the same weight, who is still growing, would need much more than this—up to 100 grams—depending upon age.

A diet which supplies less than 10 percent of its calories from protein is likely to be inadequate for the average adult. A diet which supplies over 15 percent of protein may be undesirable and uneconomical, except for those on a very low-calorie diet, as in the case of individuals who are reducing their weight.

It should be strongly emphasized that the protein needs for growth and repair of an individual are approximately the same no matter what physical activity he is engaged in—whether doing heavy physical work on the farm, playing on the football field, or engaging in sedentary work in an office or school. Of course people who are engaged in strenuous physical activity, such as laborers, miners, and lumberjacks, do need additional calories but these should, in the main, be obtained from carbohydrates and fats; they do not require more protein foods, such as meat, as is commonly believed.

The foods which supply protein. Since all animal and plant cells contain protein in the cell protoplasm, some protein will be found in nearly all foods. However, only a limited number of foods contain much protein, so it should not be very difficult to remember these few foods. Groups 4 and 5, of the Basic Seven Food Groups, include the principal protein sources.

Our most important sources of animal proteins are milk, cheese, eggs, lean meats, poultry, and fish. All these foods supply

high-quality protein. Of the plant foods, all seeds—such as cereal grains, legume seeds, and nuts—contain incomplete protein in variable amounts. Examples of legumes are peas, beans, lentils, and soybeans; the soybean is an exception in that it contains high-quality protein. Specially prepared forms of yeast contain a high percentage of protein.

Courtesy Tennessee Valley Authority

Beef steers, raised on rich pasture grass and clover, supply Americans with much of their meat—one of the most important sources of proteins, as well as other nutrients.

Foods which contain about 15 grams, or ½ ounce, of protein per 100 calories of food material are considered as containing a high percentage of protein. Such foods include lean meat, fish, poultry, glandular organs like liver, and cottage cheese.

Foods which contain 5 to 8 grams of protein per 100 calories are considered as containing a fair percentage. This group includes whole and skim milk, buttermilk, American cheese, sardines, peanuts, cottonseed flour, and legumes, such as lima beans, navy beans, and soybeans.

Those foods which contain less than 4 grams of protein per 100 calories are considered poor sources. Foods containing 2 to 4 grams per 100 calories include oatmeal, bread, cereal breakfast foods, walnuts, crackers, potatoes, and corn meal. However, since these foods are often eaten in considerable quantities, their total protein contribution to the daily requirements may be rather important.

In times of meat shortages it becomes necessary to use other animal and plant sources of protein as alternates or substitutes. Meat may also be a luxury food in time of high prices. It is well to know that while meat is an important food it is not indispensable.

Milk, which contains approximately 34 grams of protein per quart (see page 151), can be an important source of high-quality protein when consumed in the recommended amounts of 1 quart daily for children and 1 pint for adults. A pint of milk will supply about 25 percent of the day's needs (70 grams) of protein for the average adult. A quart of milk for the child and youth will supply an even higher percentage of their daily needs. The chart on page 87 shows the protein equivalents of milk and several other common foods.

How you can meet your protein needs each day. About half of the adolescent's or youth's daily protein needs (75 to 100 grams) can be met by eating two or three servings of high-protein foods, as shown in the following examples. These same amounts will supply over half of the adult's daily protein requirements (60 to 70 grams).

Example One

2 glasses of milk	17.2 gm
1 egg	5.8 gm
1 serving of meat	18.2 gm
Total	41.2 gm

Example Two

½ C cottage cheese	23.0 gm
1 serving of chicken	21.8 gm
Total	44.8 gm

Example Three

2 glasses of milk	17.2 gm
½ C of soybeans	29.7 gm
Total	46.9 gm

The rest of the protein needs for the day can be obtained from the various plant sources previously mentioned or from additional animal foods or larger servings of the same.

For Review

1. What are proteins?
2. What are amino acids? What are essential amino acids?
3. What is a "complete protein"? An "incomplete protein"?

4. What are the functions of proteins?
5. What are the protein needs of youth? How do they compare with the protein needs of children and adults?
6. What effect does an increase in physical activity have upon a person's protein needs?
7. How do animal sources of proteins compare in food value with plant sources of protein?
8. Name common foods which are high in protein content.
9. How much protein does a quart of milk supply?
10. How much protein does a 4-ounce serving of meat supply?

For Personal Application

1. Analyze a single meal for its protein content, using Table 10, in Appendix A, for your information.
2. Analyze one or more of your day's diets for their protein content. How do the amounts compare with the Nutrition Yardstick for you?
3. If the diet analyzed in item 2 is found to be deficient in the amount or quality of protein, suggest additions or substitutions which will bring the meals up to the desirable protein content.
4. List five or more foods high in protein content.
5. What is the total number of grams of protein supplied by 1 quart of milk, one egg, and one serving of fish? What percentage of your day's requirement is supplied by these three items, assuming that they are eaten on the same day?

7

MINERALS PERFORM TWO OF THE THREE FUNCTIONS OF FOOD

> A lasting improvement in the food habits of pupils depends upon the development of a carefully planned, school-wide program built around their everyday food experiences and designed to reach both pupils and parents. Such a program should be related to the prevailing food habits and the food resources of the locality.
>
> BESS GOODYKOONTZ[1]

Of the 13 minerals and associated elements mentioned in Chapter 1, we are discussing in detail only five—namely, calcium, phosphorus, iron, copper, and iodine. We know more about these five minerals than we do about the others, and they are frequently deficient in our diets.

Further, we know that foods selected so as to supply enough calcium, iron, and iodine, will usually furnish enough phos-

[1] Of the U.S. Office of Education; as quoted in "School Lunches for Your Children," *Nutrition in Review*, Report of the New York State Joint Legislative Committee on Nutrition, 1945.

phorus and copper, as well as magnesium, manganese, and the "trace" elements cobalt and zinc, to permit the processes of the body to function properly.

The functions of minerals are (1) to promote growth and repair body tissue and (2) to help regulate body functions. Each mineral assists in these functions in its own specific ways. Minerals do not supply calories.

It should be emphasized that the individual minerals do not work alone; they require the presence and assistance of other minerals. They also require the presence of vitamins in the right amounts if they are to be put to the best use in the body.

In this chapter each of the five important minerals is discussed from the standpoint of its functions, including effects of deficiency, the amount needed, and the food sources from which it may be obtained.

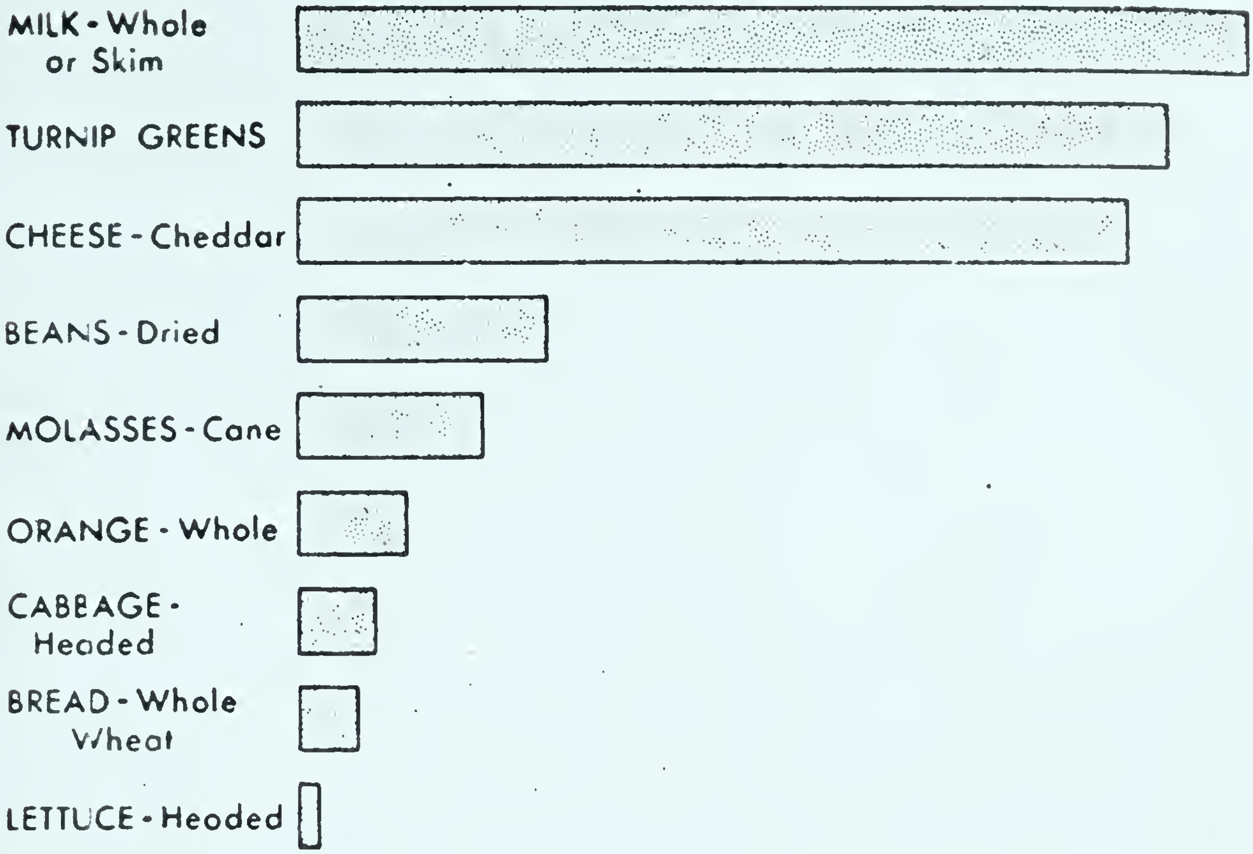
The Importance of Calcium

Calcium is the most abundant mineral in the body. Ninety-nine percent of the calcium of the body is in the bones and teeth in the form of chemical compounds which also contain phosphorus. The remaining 1 percent of this mineral is found in the blood stream and in the soft tissues. An adult contains 2 to 4 pounds of calcium. The amount of calcium in a 50-pound child is about equal to that in over 300 pieces of writing chalk.

Functions of calcium. Calcium is essential for the building of strong bones and for the development of sound teeth. It assists in the clotting of blood following injuries. Calcium helps to maintain the normal functions of the nerves and muscles, including the regular beating of the heart. This mineral is necessary in the prevention of rickets. It is also essential in lactation.

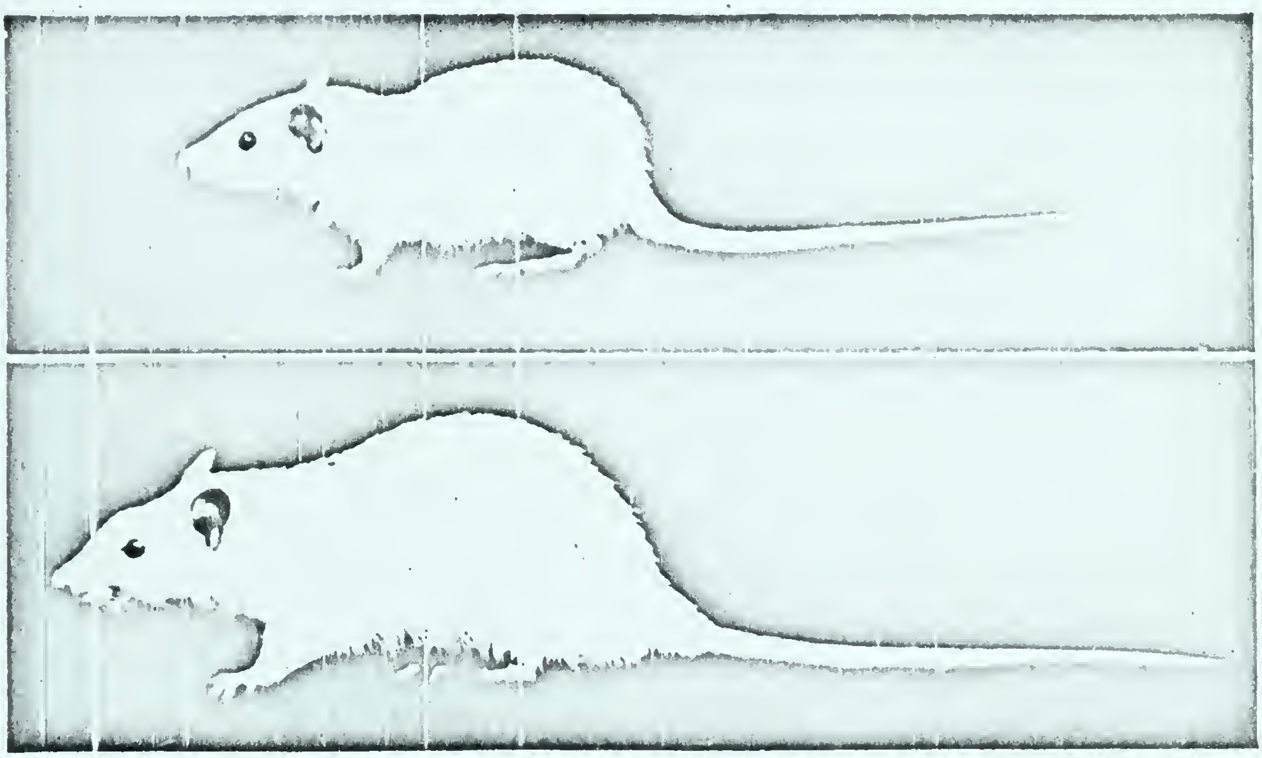
Amount of calcium needed. The amount of calcium—and phosphorus—needed is in part dependent upon the amount of vitamin D which the diet contains, because this vitamin aids the body in economizing on calcium and phosphorus. In the presence of a plentiful supply of vitamin D, the requirement for calcium per day for a child four to six years old is 1,000 milligrams (see

Calcium in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of milk—8 ounces—contains 283 milligrams of calcium.



Courtesy Bureau of Human Nutrition and Home Economics

The rat at the top, which did not have enough calcium, weighs 91 grams. Note the short, stubby body, which is the result of poorly formed bones. The other rat, which had plenty of calcium, weighs 219 grams. It has reached full size, and its bones are well formed.

page 26). Girls and boys of thirteen to fifteen years need 1,300 and 1,400 milligrams, respectively. A man or woman requires 1,000 milligrams daily. A quart of milk, which contains 1,150 milligrams of calcium, will supply the daily needs for most of these individuals.

The calcium requirements are greatest when the body is building bones and teeth. Therefore, it is very essential that children have an abundant supply of this mineral until their skeletons are fully developed. Stunted growth and deformities of the bone may result when a child does not have enough calcium in his diet. These topics are discussed under the subject of vitamin D and rickets in Chapter 9. Insufficient calcium in the diets of adults leads to poor mineralization of the bones, and the nerves and muscles do not function satisfactorily. The relation of calcium to the teeth is discussed in Chapter 13.

The Nutrition Yardstick shows that women need increased amounts of calcium during pregnancy and nursing. Both the mother and the child may be affected if the diet is inadequate in this mineral. At least 3 pints of milk per day are necessary to supply the calcium needs of a pregnant or nursing woman.

A property of calcium. Calcium, as well as other minerals found in food, is soluble in water. It is therefore readily lost when food is soaked or cooked in water. The water in which vegetables have been cooked should not be thrown away. It can be used, for example, in soups and gravies. The mineral loss can be reduced by keeping to a minimum the amount of water used and the length of time for cooking.

Sources of calcium. Table 10 in Appendix A shows which foods are best sources of calcium. Note that leafy vegetables, as well as milk and milk products, are especially rich in calcium. In spite of the fact that calcium is fairly abundant in natural foods, it is one of the most common deficiencies in the diets of Americans.

How you can meet your calcium needs each day. How the major part of the day's needs (1,000 to 1,400 milligrams) of calcium can be met is shown by the following examples of foods relatively high in this mineral:

2 glasses of milk	578 mg
1 serving of broccoli	130 mg
½ C of string beans	65 mg
1 average-sized baked potato	16 mg
1 oz of cheese	244 mg
Total	1,033 mg

Other foods in the day's meals no doubt will contain sufficient additional calcium to meet the higher requirements of some individuals. An additional glass or two of milk will, of course, assure an adequate amount of calcium for anyone.

The Place of Phosphorus in Body Growth

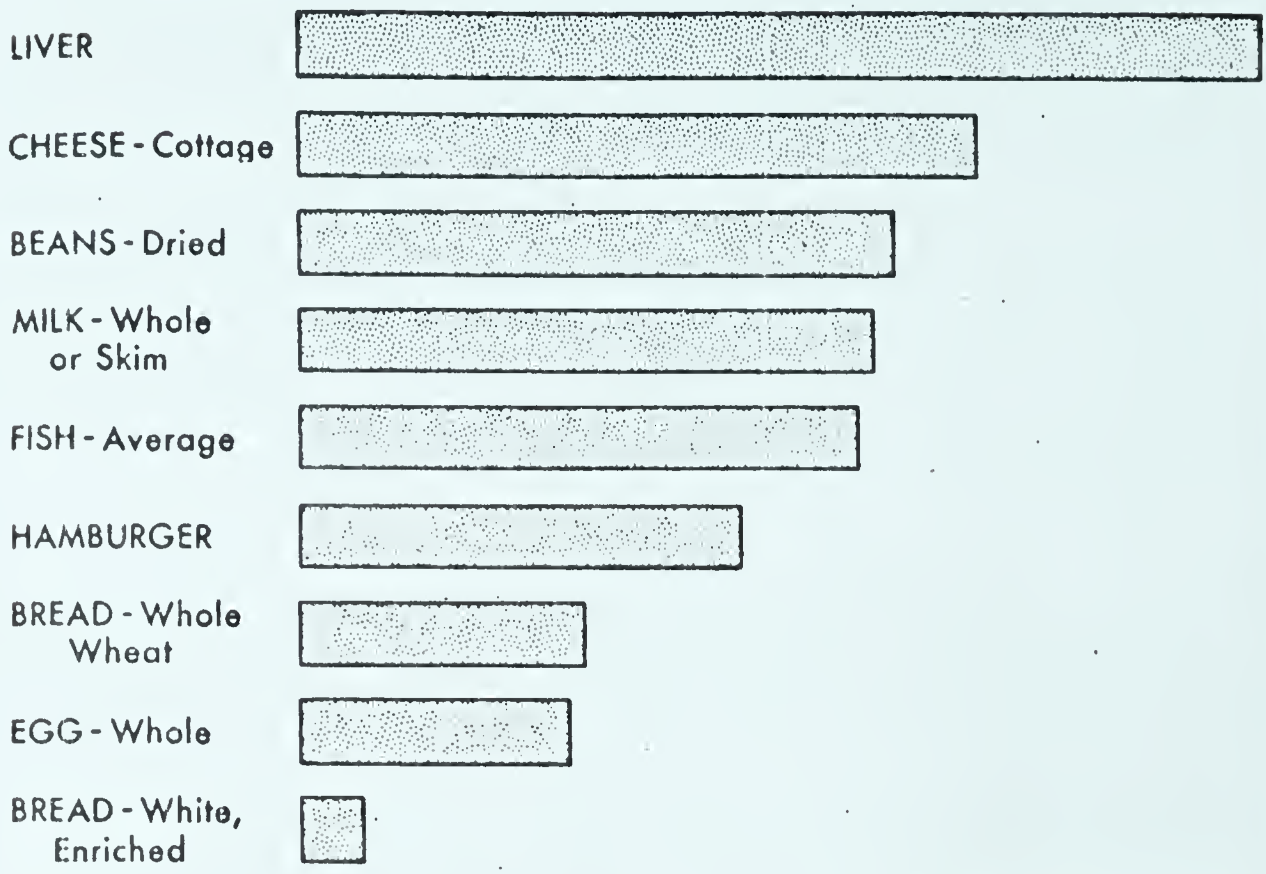
Phosphorus is an important part of all the cells of the body. There are almost 2 pounds of this mineral in the average-sized man. About 70 to 80 percent of the phosphorus is in the skeletal structure of the body.

Functions of phosphorus. Phosphorus, along with calcium, is essential for the building of strong bones and sound teeth. Phosphorus is necessary in the prevention of rickets. It acts as a buffer in the blood and muscles. This mineral is also necessary to the normal metabolism of carbohydrates and fats.

Amount of phosphorus needed. The amount of phosphorus needed by the body is not shown in the Nutrition Yardstick. However, the National Research Council does recommend that the amount of phosphorus should at least equal that of calcium in the diets of children and of women during the latter part of pregnancy and during lactation. In the case of other adults the phosphorus allowances should be approximately 1½ times those for calcium. Insufficient phosphorus in the diet, especially of growing children, will lead to poor development of the bones and teeth and may result in rickets. Growth may be retarded.

Sources of phosphorus. Foods that are rich in calcium—such as milk and milk products—also contain a high quantity of phosphorus. The animal sources of proteins are also rich in phosphorus. Therefore, when the calcium and protein needs have been met, it generally can be assumed that the phosphorus needs have also been met. Eight ounces of beef or a pint of milk will supply 450 milligrams of phosphorus.

Phosphorus in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of fresh liver—3½ ounces—contains 373 milligrams of phosphorus.

Proteins, although good sources of phosphorus, are not good sources of calcium. Therefore, if the phosphorus supply is obtained from animal sources rather than from milk, the diet should be supplemented for calcium by green, leafy vegetables. Milk and milk products are the only foods that are high in both calcium and phosphorus.

How you can meet your phosphorus needs each day. The amount of phosphorus consumed by children should at least equal that of calcium. The following food list illustrates how a wise choice of common foods can supply a major share of the day's phosphorus needs for most individuals:

2 glasses of milk	456 gm
1 serving of meat (beef)	196 gm
2/3 C of lima beans	158 gm
1/2 C of fresh peas	98 gm
1 egg	94 gm
1/2 C of macaroni and cheese	70 gm
Total	1,072 gm

Why We Need Iron in Our Food

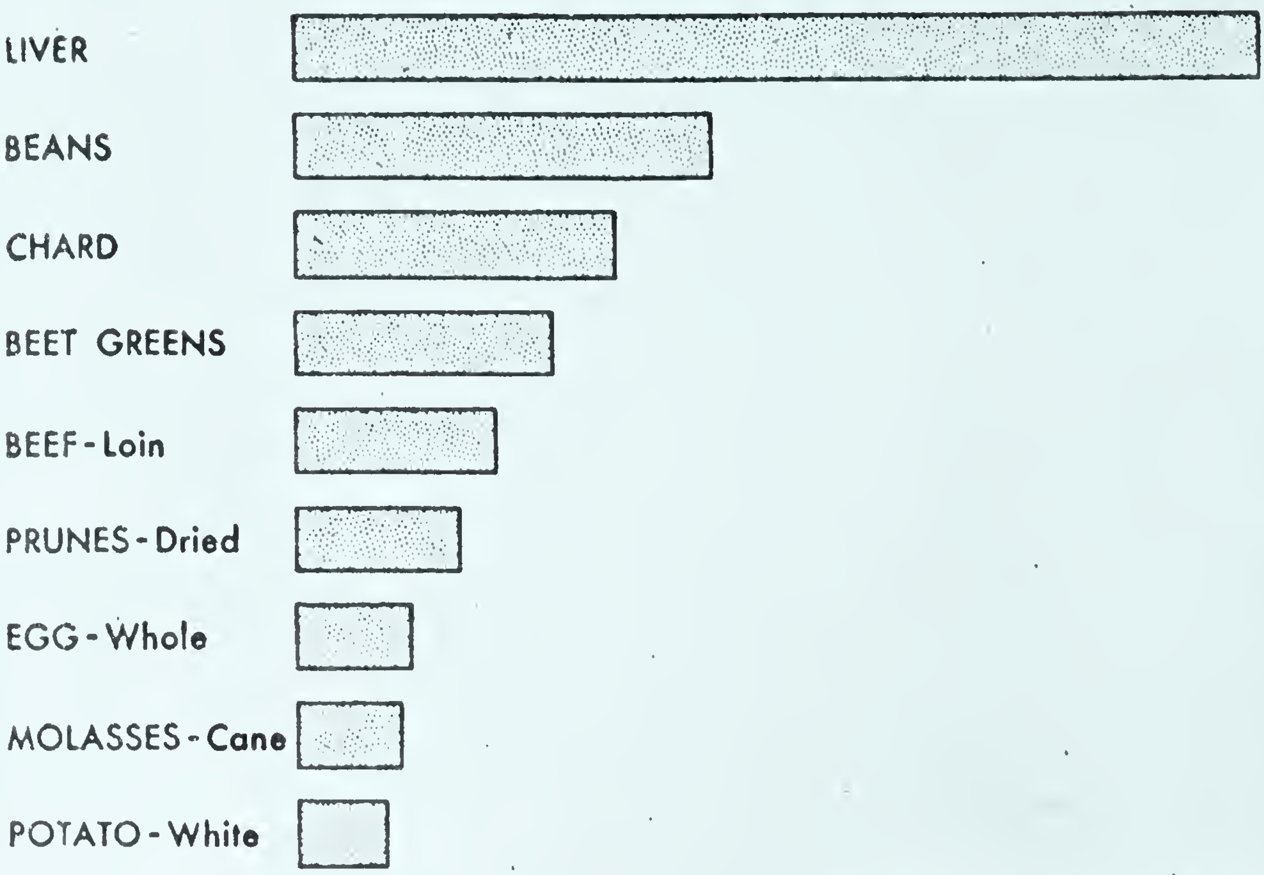
An adult in normal health contains about 1/10 to 1/7 ounce of iron in his body, which is equivalent to the amount of iron in a small nail or in four bobby pins. Even if this amount is small, it is of vital importance to the human mechanism.

Iron is stored in practically all the organs of the body, but most of it is in the hemoglobin of the red blood cells. The rest of the iron is in the liver, the spleen, and the marrow of the bones as a reserve for use in making hemoglobin. The bone marrow is the factory in which hemoglobin and red blood cells are made. It is estimated that a trillion new cells are produced daily in persons of good health. The old cells are continuously being worn out and discarded. Fortunately, the body is economical in its use of iron, since it uses over and over again an appreciable amount of the iron extracted from the old and worn-out cells.

Functions of iron. Iron is essential in the formation of hemoglobin and red blood cells. The red cells have the very important job of transporting oxygen from our lungs to all the cells of the body. The oxygen is necessary in order that the energy foods in our bodies, such as sugar and fat, be burned to supply us with heat and power. Consequently, an adequate supply of iron enables the red blood cells to carry on this important function of transporting oxygen. Iron is also necessary for a normal complexion, since the amount of hemoglobin in the blood is an important factor in determining the appearance of one's complexion.

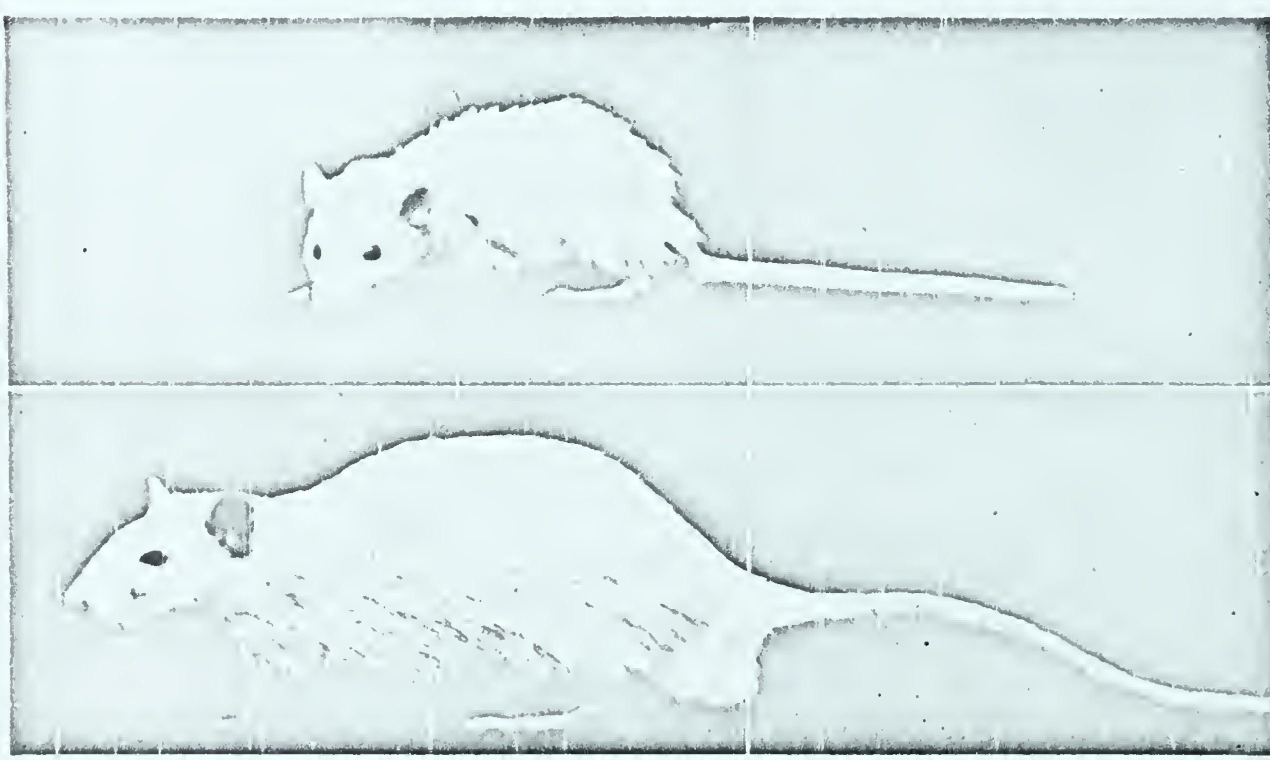
Amount of iron needed. Both boys and girls need 6 to 15 milligrams of iron daily. Men and women need 12 milligrams; since women are smaller than men, this means that women are getting proportionately more iron than the men. An adolescent girl or a woman, in proportion to her size and weight, needs more iron because of the loss of hemoglobin—and therefore iron—which occurs during menstruation and pregnancy. Furthermore, since a baby is born with a 6 months' supply of iron, a woman needs sufficient iron in her food during pregnancy to meet this need as well. For these reasons, the iron requirement for women during pregnancy and lactation goes up to 15 milligrams.

Iron in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of pork liver—3½ ounces—contains 25 milligrams of iron.



Courtesy Bureau of Human Nutrition and Home Economics

The rat at the top did not have enough iron. (Weight 109 grams.) It has pale ears and a pale-colored tail. The other rat had plenty of iron. (Weight 325 grams.) Its fur is sleek, and its blood has three times the red coloring as the rat at the top.

Because women and girls need more iron than men, nutritional anemia, or anemia due to insufficient iron in the diet, is more common in girls and women than in boys and men.

When there is not sufficient iron to make enough hemoglobin or when the loss of this substance and its iron is too rapid, the body may not be able to supply sufficient oxygen to the cells from the lungs. Consequently, athletes, who need large amounts of oxygen when they exercise vigorously, must get the right kind of food to give them an adequate supply of iron in their blood stream.

Sources of iron. Foods which are good sources of iron include liver, greens, meats, egg yolk, whole-wheat bread, enriched flour, beans, peas, nuts, and molasses. A diet containing liberal amounts of these foods will ordinarily supply the necessary amount of iron.

Much of the iron in our foods is in a chemical form which is not usable by the body. So it is necessary that we take in, through the food we eat, much more iron than is actually used by the body. However, the iron in calf's liver and in egg yolk is in a form which is put to full use in the body. The iron that is in milk is also in a form which can readily be used by the body, but milk is so low in iron content that it does not fulfill the needs as a source of this mineral. Therefore, it is necessary for infants to have iron from other sources after the age of six months, when the reserve supply from pregnancy has been used up.

How you can meet your iron needs each day. Boys and girls of high school age need about 15 milligrams of iron per day. At least a few foods relatively high in iron should be included daily. Then the other foods in the diet will ordinarily be able to supply the balance of iron for the day. The following list of foods, when eaten in one day, illustrates this point:

1 serving of meat	2.7 mg
1 egg	1.2 mg
½ C of beet greens	3.2 mg
½ C of baked beans	3.4 mg
4 slices of enriched bread	1.2 mg
1 baked potato	1.0 mg
Total	12.7 mg

Two special sources of iron are liver, which has 10 milligrams in one average serving, and soybeans, which have 7 milligrams in a half-cup portion.

The Work of Copper in Our Bodies

There is only about $\frac{1}{4000}$ ounce of copper in an average-sized man. Yet copper is an essential in a balanced diet.

Functions of copper. Copper is needed in the body in order to enable iron to be converted into hemoglobin. Therefore copper is necessary to the formation of red blood cells. However, in contrast to iron, there is no copper actually in hemoglobin or red cells.

Amount of copper needed. The requirement of copper in adults is about 1.0 to 2.0 milligrams a day. For infants and children the amount needed is about 0.05 milligram for each kilogram of body weight. When the diet lacks the required amount of copper, the effects are similar to those arising from inadequate iron—namely, anemia and impaired respiration due to poor utilization of the iron.

Sources of copper. Since copper is found in most of the foods which also contain iron, it is very probable that one's copper needs are met when those for iron are adequate.

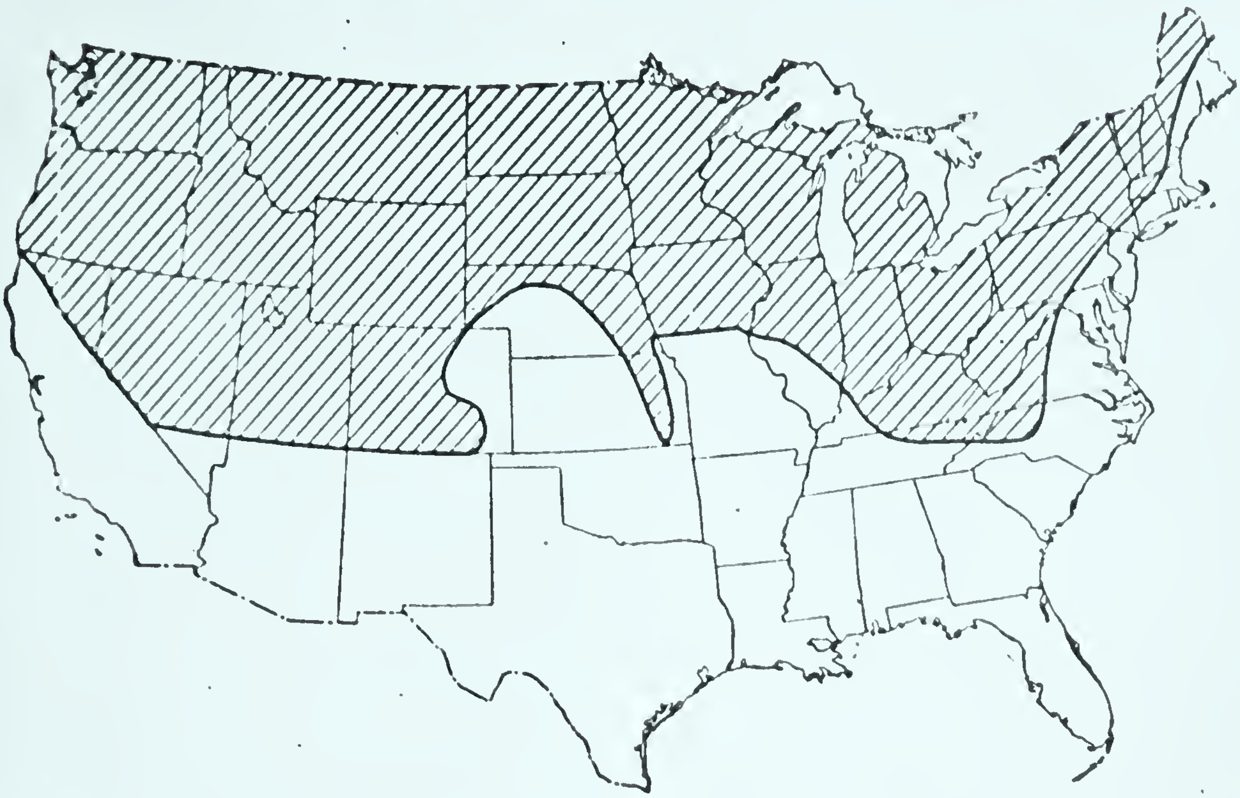
Why We Need Iodine

Iodine has been of considerable interest to the public for a number of years because of its relationship to goiter. About 10 milligrams of iodine is contained in the hormone (thyroxin) of the thyroid gland. The rest of the body contains small amounts of iodine, depending upon how much is included in the diet.

Functions of iodine. The functions of iodine relate to its rôle as a part of the hormone (thyroxin) of the thyroid gland. This gland is located in the front of the neck. It regulates the rate of metabolism and influences growth.

The thyroid gland tends to enlarge when it is not getting enough iodine in the diet. This is known as simple goiter. It can

Where Iodine is Lacking in the Drinking Water



Courtesy "Journal of the American Medical Association" (after McClendon)

The goiter area in the United States corresponds approximately to the shaded area on the map. Within this area the drinking water contains less than 22 parts of iodine per hundred billion parts of water.

be cured by supplying sufficient iodine, as explained later (see page 104).

The relationship of the thyroid gland to growth is illustrated by the fact that if an infant is born with a defective thyroid gland he does not grow normally and is mentally retarded. He is known as a cretin. When the cause is discovered early enough and the infant is given thyroid extract, the body will acquire more normal proportions and the intelligence will improve.

Amount of iodine needed. The daily requirement for iodine ranges from 0.15 to 0.30 milligram per day for adults. The need for iodine is greater for young people and for women in pregnancy.

A deficiency of iodine in the diet, and therefore in the thyroid gland, may lead to subnormal basal metabolism which sometimes is associated with overweight. In instances of extreme deficiency in children, a lack of iodine leads to a stunting of the

growth, known as cretinism. Lowered mental ability, nervousness, and sensitiveness to infection are also associated with an inadequate supply of iodine.

The most serious result of a deficiency of iodine is goiter. It is an enlargement of the thyroid gland which usually shows up as a swelling in the throat. Goiter and other deficiencies due to a lack of iodine are most common in those areas of the world in which the soil is deficient in iodine salts. The soil is deficient because iodine salts happen to be very soluble in water. For centuries rains have dissolved out the iodine salts from these soils and have carried them to rivers and eventually to the sea. Land in mountainous regions, especially, is likely to be low in iodine. The water in such areas, whether from springs, wells, lakes, or streams, is also deficient in iodine. Therefore, any foods raised on these soils, such as cereals, vegetables, and fruits, are poor in iodine. Because the pasturage and fodder eaten by animals in these regions do not contain sufficient iodine, the milk, eggs, beef, mutton, and other foods obtained from the animals will also be deficient in this element.

The soil near the seacoast is likely to be relatively high in iodine because the rivers have carried the iodine salts from higher areas to the seacoast and the sea. Salt water is also high in iodine. A cubic mile of sea water contains a minimum of 90 tons of iodine. In parts of the oceans that contain beds of seaweeds, kelp, and sponges, a cubic mile may contain from 10 to 100 times as much. This is the reason why foods obtained from the ocean are excellent sources of iodine, and why goiter is rare or nonexistent near salt water.

The main goiter belts in the United States are shown in the map on page 102. In these areas the soil and the drinking water are low in iodine. The Great Lakes region is one of these areas. Some of the cities bordering on these lakes use lake water for drinking purposes. This water is low in iodine. However, nowhere in North America do the inhabitants of any area suffer from iodine deficiency to the extent that is or has been the case with the inhabitants of certain regions of Switzerland, Austria, France, Italy, and India.

Sources of iodine. There are usually three ways of meeting the need for iodine in iodine-deficient regions: (1) from food which has been raised elsewhere on soil high in iodine; (2) from table salt fortified with iodine; and (3) from drinking water to which iodine salts have been added. The use of iodized table salt is the most common way to obtain iodine in regions where the soil is deficient in this mineral.

Before modern processes for refining salt were developed, most table salt contained iodine. Therefore, there were fewer cases of goiter than there are today. In the present-day methods of refining crude salt for table use, the iodine salts are decomposed and consequently lost.

Some states in the goiter areas permit only the sale of iodized table salt. In states where such laws do not exist, iodized salt, as well as noniodized salt, is usually available in the grocery stores. The American Medical Association and other organizations acquainted with the health aspects of the goiter problem have recommended that federal legislation be enacted which would require that all table salt be iodized.

Excellent sources of iodine are cod-liver oil; fish from the sea; sea foods, such as oysters, shrimps, clams, and lobsters; and iodized salt. Vegetables, cereals, fruits, and dairy products are good sources of iodine, provided, of course, that they have been grown on soil which has a sufficient iodine content. It would be difficult to calculate accurately the amounts of this mineral in our diets without knowing where the food was grown.

For Review

1. What minerals are needed by the human body?
2. Which minerals are usually included in the average diet and there fore ordinarily need not be planned for specifically?
3. Which minerals are most frequently deficient in our diets?
4. What are the functions, amounts needed by different age groups and different sexes, and sources of calcium? Of phosphorus? Of iron?
5. Discuss milk as a source of calcium, phosphorus, and iron.
6. Discuss copper as a nutrient.

7. What is goiter?
8. How can deficiencies of iodine in a given area be met?

For Personal Application

1. Analyze one or more of your diets for a day for the amounts of iron, calcium, and phosphorus that you are obtaining. How do the totals for each of these minerals compare with the amounts recommended for you? Is each meal contributing its share of the various minerals?
2. If your diets are deficient in calcium or iron, suggest foods for addition or substitution which will bring the diets up to the desirable content for each of the minerals.
3. Make a list of 10 foods which are relatively high in iron. Make other lists for calcium and for phosphorus. In which Basic Seven Food Groups are these foods found?
4. Make a list of foods which are low or deficient in iron. Make other lists of foods low in calcium and those low in phosphorus. In which of the Basic Seven Food Groups are these foods classed? Are some foods not in any group?
5. Name five or more foods which are high in more than one of the three minerals—iron, calcium, and phosphorus. To what extent are these desirable foods ordinarily included in your diet?

8

THE VITAMINS ARE THE MOST RECENTLY DISCOVERED NUTRIENTS

It is the alert, the well-educated, the economically favored housewife who responds promptly to new and attractive food products and to information about foods and feeding. It is the less well-informed, the isolated and remote family which learns slowest and avails itself least of technological advances. The benefits start largely in nonmarginal homes, thence filter down through the strata of society and often fail to reach areas at the lower levels.

R. R. WILLIAMS[1]

In 1912, Dr. Casimir Funk, a biochemist, tried to find what it was in foods that prevented beriberi. On the basis of his own studies and those of other scientists, he was led to believe that there were certain unknown substances present in some foods which would prevent scurvy, beriberi, and probably pellagra. He believed these to be nitrogen-containing substances similar to amines. He

[1] From "What Progress in Nutrition," *Nutrition Reviews*, September, 1947. Dr. Williams was the first scientist to synthesize thiamine.

also believed that these substances were essential to life, and so he coined the word "vitamine" (*vital* plus *amine*) for them.

Later studies showed that some of these substances did not contain any nitrogen, and therefore the final "e" was dropped from the name to get away from the chemical designation of amine—or a substance containing nitrogen. Since 1912 a great deal has been learned about the mysterious and wonderful substances known as vitamins, and no doubt a great deal more is yet to be discovered.

The Nature of Vitamins

A considerable amount of information is now available about vitamins. Additional information is constantly being discovered in the many research laboratories devoted to vitamin research. Some of the facts of general interest are here presented.

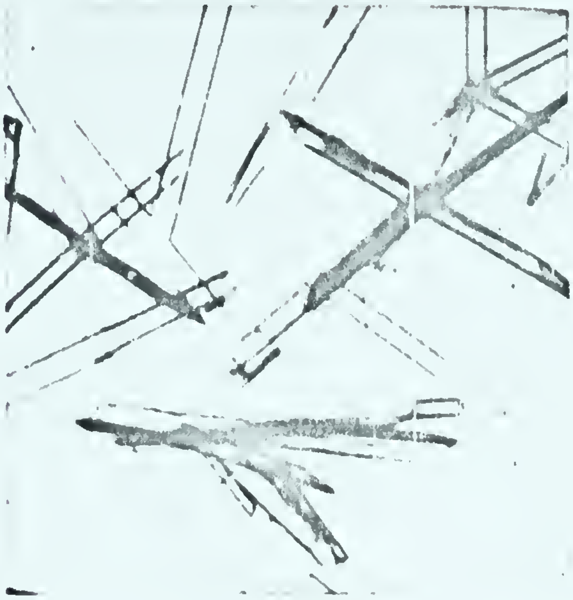
Just what is a vitamin? We know that each vitamin has definite chemical and physical properties and definite functions which differentiate it from other nutrients. Vitamins differ from proteins, fats, and carbohydrates in that they do not supply energy. They differ from proteins and minerals in that they do not supply building material for the body structure. Their general functions are to assist the body to use these other nutrients and to act in other ways as regulators or catalysts.

You can't taste vitamins in food. You can't smell them either. You can't see them in the foods which you eat, with one exception: The yellow color in various vegetables and fruits is a pigment known as carotene from which our bodies and animals' bodies can make vitamin A. But that vitamins actually exist is evident from microscope pictures which have been taken of purified and synthetic vitamins. In their pure form vitamins can be seen, tasted, and weighed. They are as real as your table salt.

The actual amount of each of the vitamins that you need daily is very small. But their importance to you is very great. A few ounces of each of the vitamins would be a sufficient supply for a lifetime. Therefore, very small units of weight, such as the milligram, are used in measuring vitamins. The milligram is 1/1000

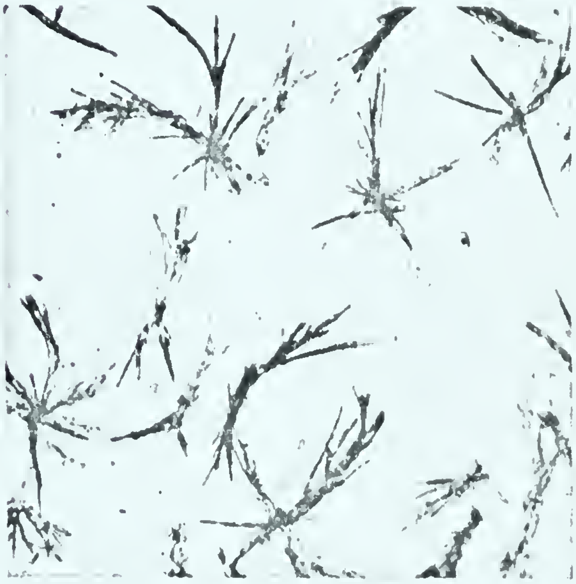
Vitamins Under the Microscope

Vitamin A

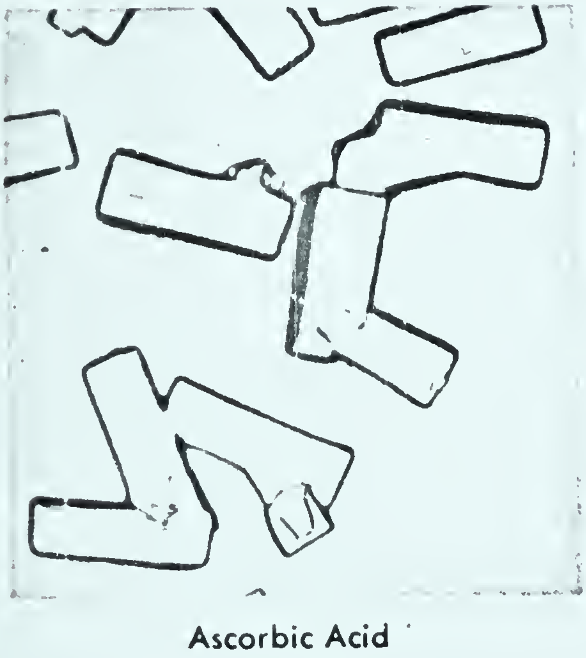


Thiamine

Riboflavin



Niacin



Ascorbic Acid

Each vitamin, as well as other nutrients, has its own specific physical and chemical properties.

Photo at top, left, courtesy Distillation Products, Inc. All others courtesy Merck and Company, Inc.

gram or 1/28,000 ounce. Those vitamins which are needed in even smaller amounts are measured in units of micrograms, or gamma, which are 1/1000 milligram. Vitamins must be very potent to be so useful even in such small quantities in the foods that we eat.

Why do we need vitamins? Extreme deficiencies of certain vitamins may result in such ailments as scurvy and pellagra. However, in this country it is rare for a person to have scurvy and pellagra because it is almost impossible—with our abundance and variety of foods—not to obtain some of the vitamins needed to prevent these ailments. Yet, in many other countries of the world, such as China and India, these diseases are prevalent.

Nevertheless, studies show that a large percentage of Americans are not obtaining all the necessary vitamins in their daily diets and that many people who are otherwise healthy could be made to feel and look better if their diets were well balanced as far as vitamin content is concerned.

A total or pronounced lack of one or more of the essential vitamins will result in serious illness; a partial lack may lead to a condition that is not recognized by the individual as an ailment but which prevents complete health or well-being. Health experts are consequently aware of the fact that there are many degrees of vitamin deficiencies. In general, if a person lacks one vitamin in his diet, other vitamins are also likely to be deficient.

There are many ways in which an adequate amount of the various vitamins in your diet will improve your health. Many types of ailments may be lessened or helped: you may not tire so easily; you may sleep better; you may be able to participate in sports and other activities without becoming fatigued so readily; you may reduce nervousness and irritability; your eyesight may improve; your fingernails may not break so quickly. On the whole you will be healthier, stronger, and more efficient when your diet includes sufficient amounts of vitamins along with the other nutrients.

Sometimes people do not consume enough vitamins because they are not eating enough food. People who are doing sedentary work usually do not eat in volume as much as those doing physical

work. They of course need fewer calories. But in the process of reducing their energy intake, they may also reduce the amounts of vitamins and minerals, which are needed no matter what the volume of food eaten or the number of calories in the diet. Without the necessary vitamins, our appetites lag and our food is not digested properly.

How are vitamins named? The first vitamins that were discovered were given names of the alphabet—A, B, and C. Now, since the chemical composition of the vitamins are better known, they have been given names which indicate what they are chemically.

One of the earlier classifications of vitamins was on the basis of their solubility. The water-soluble vitamins are the B vitamins and vitamin C. The fat-soluble vitamins are A, D, E, and K. The water-soluble ones are more readily lost through faulty cooking procedures, so it is well to remember that the B vitamins and vitamin C are water-soluble.

For a number of years vitamin B was thought to be one vitamin. In time scientists discovered that it is actually a combination of several vitamins. It is now known that what was originally vitamin B consists of at least 12 vitamins required by the body in small amounts and of several other substances about which little is known. Therefore, they are referred to as the B-complex vitamins. Several of these vitamins are being made synthetically and sold commercially in vitamin tablets. The similarity between the various B vitamins is limited to the fact that they are all water-soluble and that they are frequently found in the same foods.

The B-complex group. Three of the B-complex vitamins are listed in the Nutrition Yardstick—thiamine, riboflavin, and niacin. More is known about these three than about the other nine B vitamins, and it has definitely been established that they are valuable to humans. We shall later discuss them in detail.

Other B-complex vitamins include pyridoxine, pantothenic acid, choline, biotin, inositol, para-aminobenzoic acid, folic acid, vitamin B_{10}, vitamin B_{11}, and vitamin B_{12}. Because nearly all these vitamins are widely found in food, some experts believe

that they are probably seldom lacking in the average American diet.

The B vitamins are not stored in the body to any extent, and so they need to be supplied daily in the diet. They are used up or are excreted from the body within a few hours after being eaten.

Certain types of bacteria living in our intestines are able to make some of the B vitamins, thereby contributing generously to our supply.

In most instances, natural foods contain several of the vitamins rather than just one. Of the various foods which are high in B-complex vitamins, dried brewer's yeast is the richest source, weight for weight.

Diseases due to insufficient B vitamins are rarely found alone. A person who has some form of thiamine deficiency is likely also to have some symptoms of riboflavin and niacin deficiency.

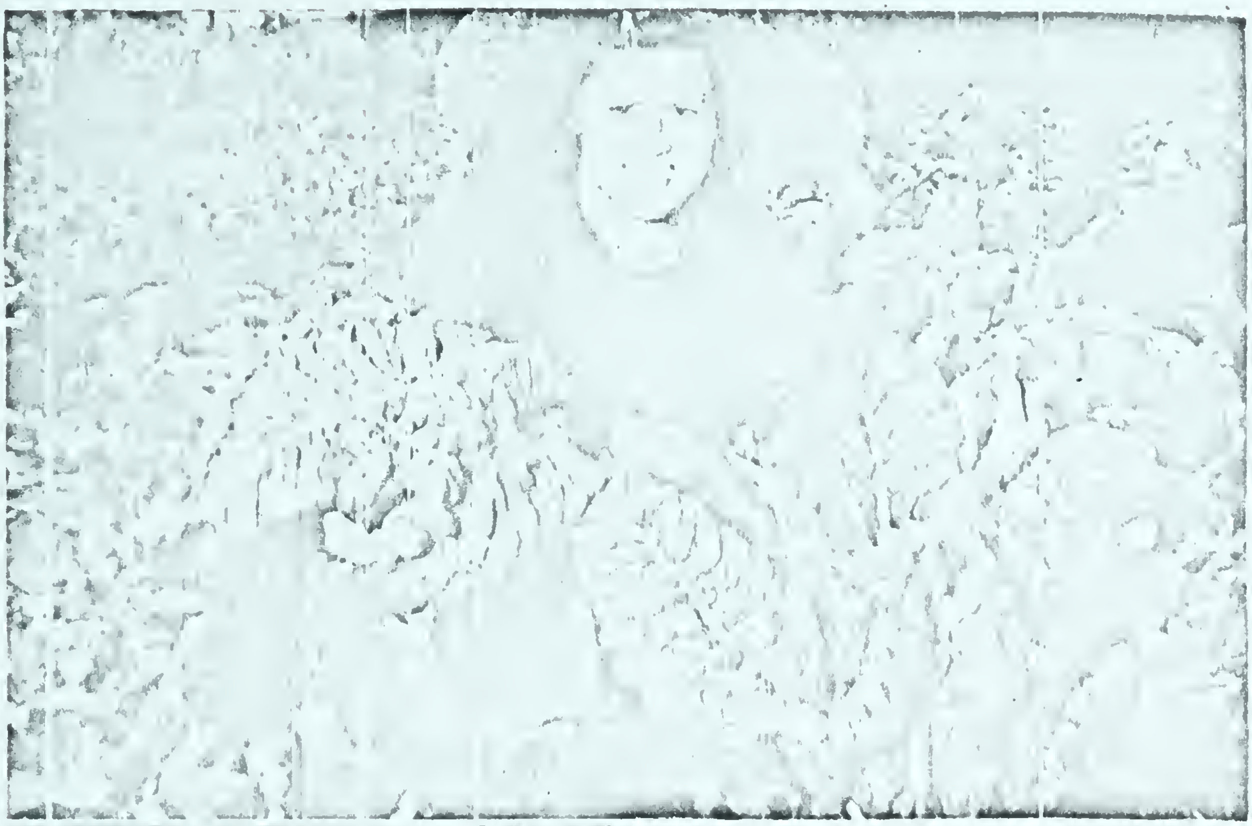
Sources of Vitamins

In addition to understanding something about the several vitamins included in the Nutrition Yardstick, it is essential to know the sources of these vitamins.

Where can we get these vitamins? Fortunately, vitamins are found in all foods except highly refined sugar and starch and some forms of fat, such as lard. But because we eat so much of these refined foods, it has become that much more important that we plan our daily diets to include the vitamins which are lacking in such foods.

It has been said that the greatest vitamin factory on earth is the farm where vitamins are supplied by plants, animals, and even by sunshine. The plants make and store vitamins in their leaves, fruits, tubers, and seeds. Animals get their vitamins from their feed and from sunshine. We, in turn, get our vitamins by eating these plant and animal products and by occasionally exposing ourselves to sunlight.

That our information about vitamins is very new can be judged from the fact that it was not until 1933 that vitamin C was isolated in the pure chemical form. Riboflavin was first made



Courtesy U.S. Dept. of Agriculture (top) and U.S. Office of Education (left)

The oversupply of fruits and vegetables from the home garden in the summer can be canned, preserved, and stored to help supply vitamins in the family's meals during the winter.

synthetically in 1935. Thiamine was not successfully synthesized in the laboratory until 1936. Today the job of making vitamins in commercial laboratories has become big business. In fact, during World War II when synthetic vitamins were necessary to supplement the natural food supply, the production of most of the synthetic vitamins went from grams and ounces to thousands of pounds annually.

It is not an easy matter to make vitamins in the laboratory. Just to give you an idea of how complicated it is, here is the step-by-step process for making vitamin C: (1) corn is changed into cornstarch; (2) cornstarch is converted to glucose hydrogenated; (3) then to sorbitol (4) which becomes sorbose. (5) Sorbose is made into diacetone sorbose. (6) This chemical is next oxidized to 2-keto-1-gulonic acid; and finally (7) this acid is converted into vitamin C, otherwise known as ascorbic acid. The explanation of this chemical process should not be interpreted as meaning that we can get vitamin C by eating cornstarch!

Vitamin and mineral concentrates. The question of whether or not to use vitamin pills can't be answered by a simple "yes" or "no." It depends upon the circumstances.

As already emphasized many times in this book, it is definitely possible, and ordinarily not too difficult, to obtain a balanced diet from natural food provided (1) that you understand sufficiently what constitutes a balanced diet and (2) that you are willing and have the opportunity to apply this information. Assuming these two things, then, when may it be desirable to supplement the diet with vitamin and mineral pills?

For seemingly normal, healthy individuals supplementary vitamins and minerals may be desirable (1) when it is not possible to obtain a balanced diet and (2) when the food preparation is such that the vitamin and mineral content of the food is destroyed or lost in the cooking.

Vitamins and mineral concentrates may also be necessary for people who are restricting the amount of food which they consume—such as in reducing, in old age, and in sickness—unless great care is given to the planning of their restricted diets. Concentrates are also necessary in certain special instances to cure

The ultraviolet rays of the sun stimulate our own bodies to produce vitamin D. The less sunshine we have, the more we need to supply this vitamin from other sources.

Harold M. Lambert from Frederic Lewis

vitamin-deficiency diseases, to replenish depleted body stores, for people convalescing from medical and surgical conditions, and in preparing patients for surgical operations. The advice of a physician is needed, of course, in all these situations.

There are some additional points to know about vitamin concentrates:

1. A specific synthetic vitamin has exactly the same value as its counterpart derived from natural foods, since they are identical chemical compounds.

2. Ordinarily a person who is deficient in one vitamin is also likely to be deficient in other vitamins and minerals as well. Therefore, if vitamin concentrates are to be used, a multiple-vitamin-and-mineral pill is more likely to be needed.

3. The vitamins in pills cannot all be derived from food sources in sufficient amounts and concentration; so synthetic vitamins must be used as well. However, a naturally vitamin-rich food source, such as yeast, should be included in the multiple-vitamin preparation to ensure that other nutrients not as yet discovered or synthesized are present.

4. At the present time, according to the American Medical Association, there is no danger in the use of excessive amounts of vitamins, under ordinary circumstances, except for vitamin D. There is little evidence that other vitamins are harmful when taken in large amounts.

For an individual who is getting a well-balanced diet—that is, is meeting the Nutrition Yardstick requirements or allowances—little or no additional advantage can be obtained from vitamin and mineral supplements. The question, of course, is whether or not each of us is actually meeting the standards set by the Nutrition Yardstick. That is where an analysis of your own diet, as explained in this book, will help you to determine whether you need to improve your diet or whether you should see your physician about the advisability of supplementing your diet with the drugstore variety of vitamins and minerals.

For Review

1. What are vitamins?
2. What are the general functions of vitamins?
3. What are important sources of vitamins?
4. How are vitamins classified?
5. What is meant by the vitamin-B complex?
6. Under what circumstances might a physician advise the use of vitamin concentrates?

For Personal Application

1. Examine the labels on the containers of different kinds of vitamin concentrates obtainable from a drugstore. How do the vitamin contents and prices compare?
2. Prepare a report on the vitamin deficiencies, as well as other nutrition deficiencies, in the diets of some group or country. Such information can be obtained from various magazines and books on nutrition, dietetics, and health, as well as from other sources.
3. Prepare a report on the history of vitamin research. What were some of the early studies which led up to the discovery of various vitamins?
4. What is known about some of the vitamins not listed in the Nutrition Yardstick? Information about these and other vitamins is available in some of the more technical books and periodicals on nutrition.

9

EACH OF THE VITAMINS HAS DEFINITE FUNCTIONS IN THE BODY

> The new science of nutrition does more than show the way to better health and improved physique. It affords a solution to some of our most difficult social and economic problems. If its exponents speak with the authority warranted by the knowledge which they have acquired in recent years and use all their influence to get this knowledge applied, a review on nutrition and human welfare ten years hence may be a record of unprecedented advance in human welfare.
>
> SIR JOHN ORR[1]

In the previous chapter general information about vitamins was given. In this chapter the six vitamins in the Nutrition Yardstick will be discussed in detail. Included are vitamin A, three of the B-complex vitamins—thiamine, riboflavin, and niacin—vitamin C, and vitamin D. Each of these six important vitamins is

[1] Former Director General, Food and Agriculture Organization of the United Nations.

discussed from the standpoint of functions, including effects of deficiency, properties, amounts needed, and sources from which it may be obtained. Also considered, although briefly, are some of the vitamins not included in the Yardstick.

Vitamin A—The "Blackout Vitamin"

During World War II vitamin A acquired a nickname—the "blackout vitamin"—because it was proved that, without vitamin A in the diet, eyesight was affected, particularly at night. The following true story[2] illustrates this point.

George Miller, a young man of thirty-one, was driving one evening when he heard the familiar and ominous, "Pull over to the side of the road." The police officer threatened him with arrest for drunken driving, pointing out that he had been driving on the wrong side of the road. George had not been drinking, neither did he know that he was driving on the wrong side of the road.

He said that driving an automobile at night was difficult, especially when trying to pass an oncoming car. Even dim headlights dazzled him.

Five years before, fearing a gain in weight, George had cut out of his diet all dairy products and many vegetables. Following this, his skin gradually grew dry and began to itch. His hair became dry, brittle and lusterless and fell out in increasing amounts. When he went into a darkened motion-picture theater, he had to be guided by his wife, and the pictures seemed blurred for five or ten minutes.

Medical examinations disclosed, in addition, inflammation and dryness of his outer eyeballs. He was unable to see even a luminous watch dial in the dark.

His case was diagnosed as "intermediate between mild and severe vitamin-A deficiency," brought on because his restricted diet had eliminated most of the natural sources of vitamin A. His defective vision and the diseased condition of his skin, hair, and eyes were cured in eight weeks by the addition to his diet of butter, milk, carrots, and 30,000 additional units of vitamin A each day.

George Miller suffered from "night blindness," or lack of adaptability to semidarkness.

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[2] Henry Borsook and William Huse, *Vitamins for Health*, Public Affairs Committee, New York, 1942, pp. 1–2.

Courtesy United Airlines

Airplane pilots are all tested for their ability to see at night—called "visual acuity." Because vitamin A increases visual acuity, it is recommended that pilots eat plenty of carrots and other vegetables containing vitamin A, or carotene.

George Miller is not the only American whose diet lacks vitamin A. There are thousands of us whose diets may be deficient in this vitamin.

Functions of vitamin A. In addition to being essential for enabling the eyes to adjust to different light intensities, vitamin A is helpful in other ways. It is one of the vitamins needed for growth and for healthy teeth and bones, and so it is very important for children. Vitamin A, like several other vitamins, helps to guard against infections—for it helps to maintain the normal vitality of the epithelial cells. These cells are in the skin and in the mucous membrane which lines, for example, the mouth, nose, and sinuses.

Insufficient vitamin A may cause retarded growth, poor appetite, dry skin, and lack of vigor. People with inadequate amounts of this vitamin in their diets cannot see well to the right and left—side sight—and are therefore more prone to accidents.

Properties of vitamin A. Vitamin A is relatively stable to heat, except in the presence of oxygen. Vegetables after cooking have

been found with few exceptions to retain most, if not all, of their vitamin-A value.

Vitamin A has a so-called provitamin form, known as carotene, which is the yellow pigment in many plant foods. While yellow vegetables contain carotene, a vegetable may contain carotene without being yellow, for the yellow color is obscured in many green and red vegetables. Cows, chickens, and man are able to convert carotene into vitamin A.

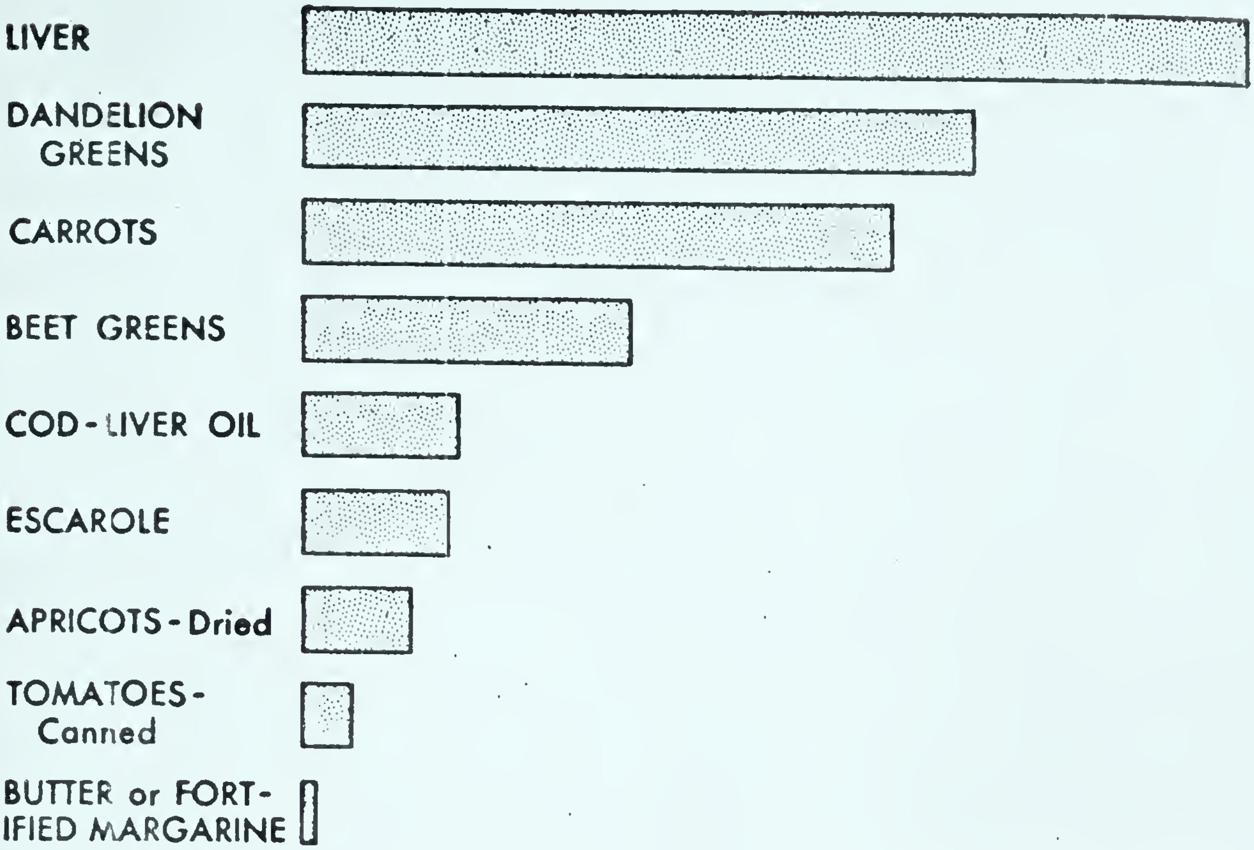
Since you can store vitamin A in your body, it is a good plan to eat liberal portions of foods rich in this vitamin when these foods are plentiful. Then you can draw on this reserve in case you should have less in your food at some later time. The liver is the storage place for vitamin A in man and animals. For this reason, animal livers are good food sources of vitamin A. Although vitamin A can be stored in the body for later use, there is evidence that including moderate amounts of vitamin A regularly in our diet gives us better protection than consuming large amounts occasionally.

Amounts of vitamin A needed. The average adult needs daily 5,000 units of vitamin A, which is, for example, the amount contained in an average-sized sweetpotato. Children under one year of age need 1,500 units. The amount increases year by year until the age of thirteen, when both boys and girls need the 5,000 units recommended for adults. Refer to Table 3 on page 26 for additional information concerning vitamin-A requirements.

Sources of vitamin A. Foods which are the best sources of vitamin A, or carotene, are liver, the yellow and green vegetables, fruits, butter, fortified margarine, egg yolk, milk, and cheese. Of the various fruits, apricots provide a large amount of this vitamin. Honeydew melons, tomatoes, yellow peaches, and cantaloupes are also good sources. One medium-sized tomato contains 1,650 units of vitamin A, or about one-third of the day's requirement for young people and adults. Table 10 in Appendix A shows which foods are good sources of vitamin A as well as of other vitamins.

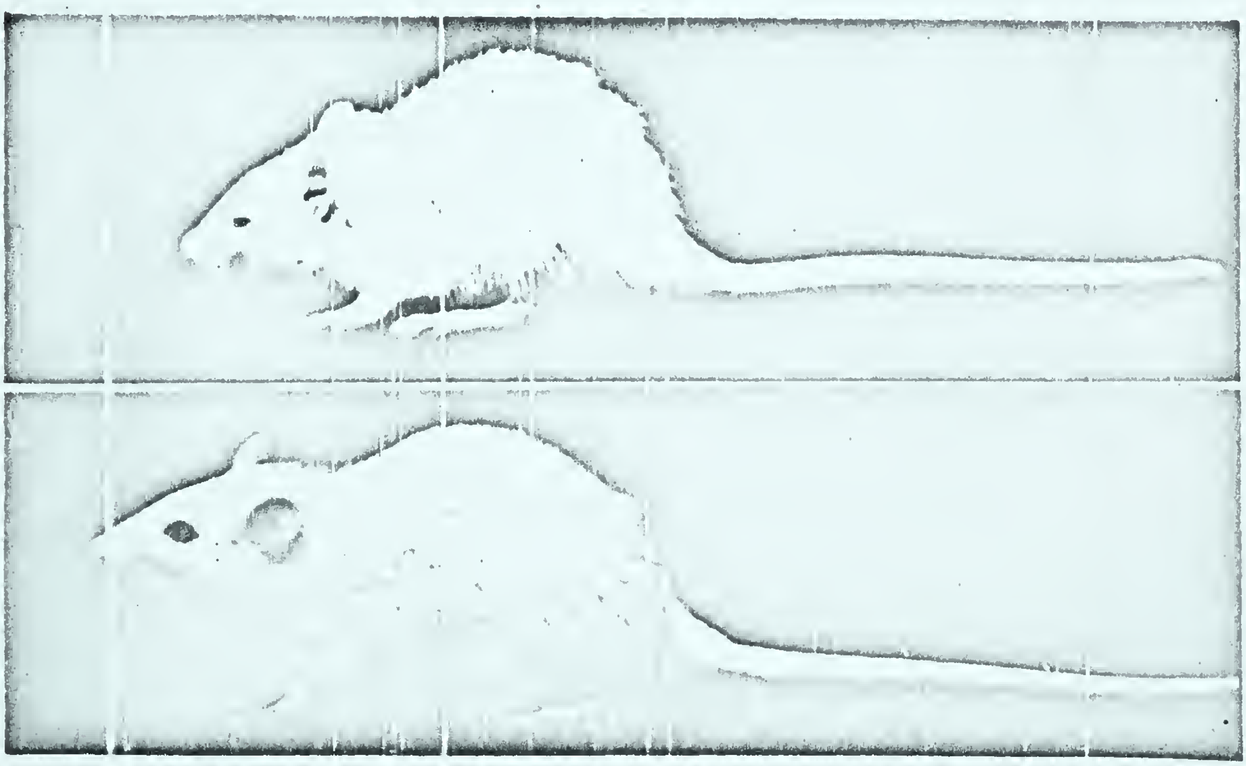
The amount of vitamin A in butter will vary according to the food which the cow eats and with the seasons—being less in the

Vitamin A in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of fresh liver—3½ ounces—contains 19,200 units of vitamin A.



Courtesy Bureau of Human Nutrition and Home Economics

The rat at the top had no vitamin A. It weighs only 56 grams. It has an infected eye, rough fur, and a sick appearance. The other rat, which had plenty of vitamin A, has bright eyes, sleek fur, appears alert and vigorous, and weighs 123 grams.

winter than in the summer. Fortified margarine is margarine that has had vitamin A added to it. In order to carry the label "Fortified," margarine must contain 9,000 to 15,000 units of vitamin A per pound. The government reports that 100 percent of the margarine produced since 1944 has been fortified. One ounce of butter or fortified margarine will supply over one-fifth of the daily requirements of vitamin A for young people and adults and one-fourth to one-half of that needed by a child, depending upon his age.

The chief medicinal source of vitamin A is fish-liver oils. Microscopic plants, known as diatoms, as well as algae and other water plants, make vitamin A. Small shell animals, called crustacea, may eat these plants and then in turn be eaten by small fish which in turn may be eaten by a larger fish, such as the cod. So the cod receives its vitamin A second- and third-hand. And we get the vitamin A from the cod in the form of cod-liver oil. A number of other fish oils also contain vitamin A. Halibut oil, for instance, is one of the richest sources of this vitamin.

How you can meet your daily vitamin-A needs. Each of the day's menus listed on pages 382 and 383 supplies more than the 5,000 to 6,000 International Units of vitamin A needed by individuals of high school age and adults. For example, the meals for Monday supply this vitamin principally through these three foods:

3 glasses of whole milk	1,176 I.U.
3 T of butter	1,386 I.U.
½ serving of beet greens	3,350 I.U.
Total	5,912 I.U.

Thiamine—The Morale Vitamin

Thiamine, otherwise known as vitamin B_1, was one of the first vitamins to be isolated and identified chemically. It is nicknamed the "morale vitamin," the "pep vitamin," and the "appetite vitamin."

Functions of thiamine. Thiamine promotes growth, stimulates the appetite, and aids digestion. It helps to steady the nerves. Thiamine is related to the metabolism of carbohydrates.

Insufficient thiamine in the diet may lead to a poor appetite, constipation, a tired feeling, a slow heart rate, nervousness, and insomnia.

An extreme lack of thiamine is the cause of beriberi, which in Singhalese means "extreme weakness." This disease has been very prevalent in various parts of the world and particularly in those countries where polished rice is the main food.

Studies of the Americans in Japanese prison camps during World War II showed that 90 percent of the men had some degree of beriberi at some time during their internment. According to one American who was kept in such a camp on an inadequate diet, "The test for beriberi is simple: You press your thumb into your leg. If the muscles fail to return to shape, you have it." Fortunately, this person was released and brought back to this country before being seriously affected by this deficiency disease.

Symptoms of thiamine deficiency frequently occur in cases of chronic alcoholism.

Certain studies[3] have been reported which indicate that thiamine deficiency may result in such vague symptoms as undue anxiety, easy fatigue, mental depression, and other symptoms which might be classified as neurosis.

To show further the effects of thiamine deficiency, we quote from a study[4] on the effects of experimentally induced thiamine deficiency carried on in one of the Mayo Clinic nutrition laboratories.

> In the course of such induced thiamine deficiency studies, we have frequently seen cheerful, happy, vigorous, industrious, young women become morose, depressed, fearful, irritable, uncooperative, and slovenly in appearance. They lack the strength to work and interest in working. It is equally phenomenal to see these same young women return to their normal selves when the intake of thiamine again is raised to an adequate level, but the longer the deficiency continues, the more difficult it is to restore these subjects.

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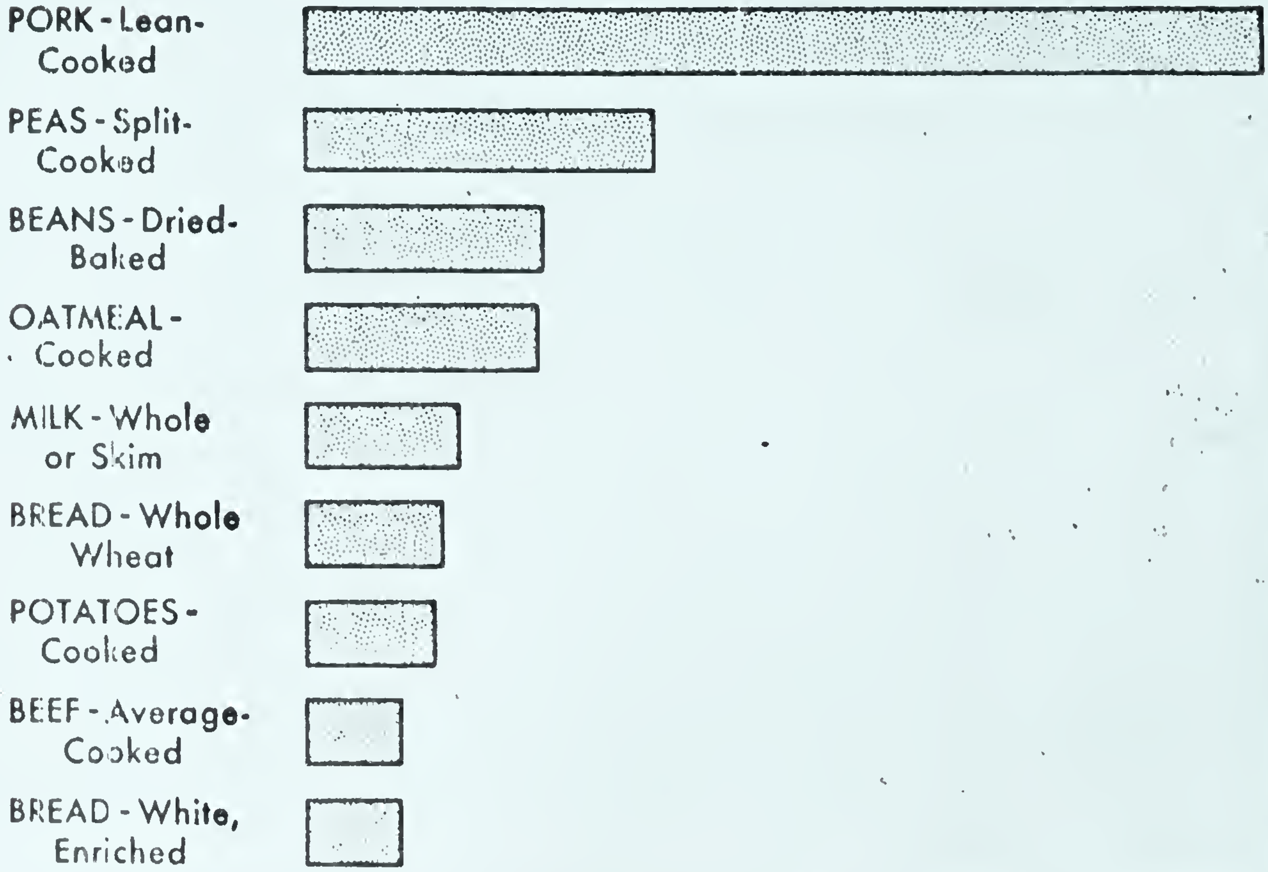
[3] R. D. Williams, H. L. Mason, R. M. Wilder, and B. F. Smith, "Observations on Induced Thiamine (Vitamin B_1) Deficiency in Man," *Archives of Internal Medicine*, October, 1940, pp. 795–799.

[4] William H. Sebrell, "The Vitamin B Complex," *Journal of the Iowa State Medical Society*, February, 1942.

Thiamine in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of lean, cooked pork—3½ ounces—contains 0.60 milligrams of thiamine.

Courtesy Bureau of Human Nutrition and Home Economics

The rat at the top, at 24 weeks, had practically no thiamine. As a result it has no ability to coordinate its muscles. The picture at the bottom shows the same rat 24 hours later, now fully recovered after receiving a food rich in thiamine.

Amounts of thiamine needed. The amount of thiamine needed per day increases from 0.4 milligram for children under one year of age to 1.3 milligrams for girls of fifteen years and 1.7 milligrams for boys of twenty years. The average requirement for men is 1.5 milligrams, and for women it is 1.2 milligrams.

There is a definite relationship between the number of calories consumed and the amount of thiamine required, which can be explained in this way: One of the functions of thiamine is to assist the body in making proper use of glucose obtained from carbohydrates. Therefore, when there is an increase in the number of calories consumed from starch and sugar because of increased physical activity, there needs to be an increase in the amount of thiamine included in the daily diet. The amount of thiamine required also increases when a woman is pregnant or nursing.

Properties of thiamine. Thiamine is soluble in water, as are all the B vitamins. This fact has important bearing upon cooking procedures. If foods, such as vegetables, are soaked or cooked at length, the vitamin is extracted. Water in which vegetables are cooked should be used in various ways in foods so that benefits are obtained from this vitamin as well as other water-soluble vitamins. Suggestions for saving vitamins in cooking are given in Chapter 15.

Thiamine is comparatively stable to dry heat. This vitamin cannot be stored, and therefore the meals for each day must supply that day's requirements.

Sources of thiamine. The best sources of thiamine are enriched and whole-wheat bread, bran, dried legumes, liver, lean meat, nuts, and yeast. Other good sources of this vitamin include chard, asparagus, eggs, fish, kale, fresh legumes, milk, potatoes, and turnip greens.

Thiamine is widely distributed among natural foods. It is because of our large consumption of refined foods, from which this vitamin has been removed, that the matter of supplying the vitamin in our diet through other sources is so important. Since 1942 the enrichment of white flour by the addition of thiamine has substantially helped to alleviate this deficiency.

How you may meet your daily thiamine needs. Thiamine needs range from 1.2 to 1.7 milligrams for high school youth and adults. How the thiamine requirements can be met is illustrated by the following foods contained in the meals for one of the days listed on page 382:

1 qt of milk	.34 mg
4 slices of enriched bread	.20 mg
1 serving of pork	.60 mg
1 boiled potato	.08 mg
1 egg	.05 mg
Total	1.27 mg

Other foods served during that day, or larger portions of the foods listed above, can supply the additional thiamine required by some individuals.

Riboflavin—Another B Vitamin

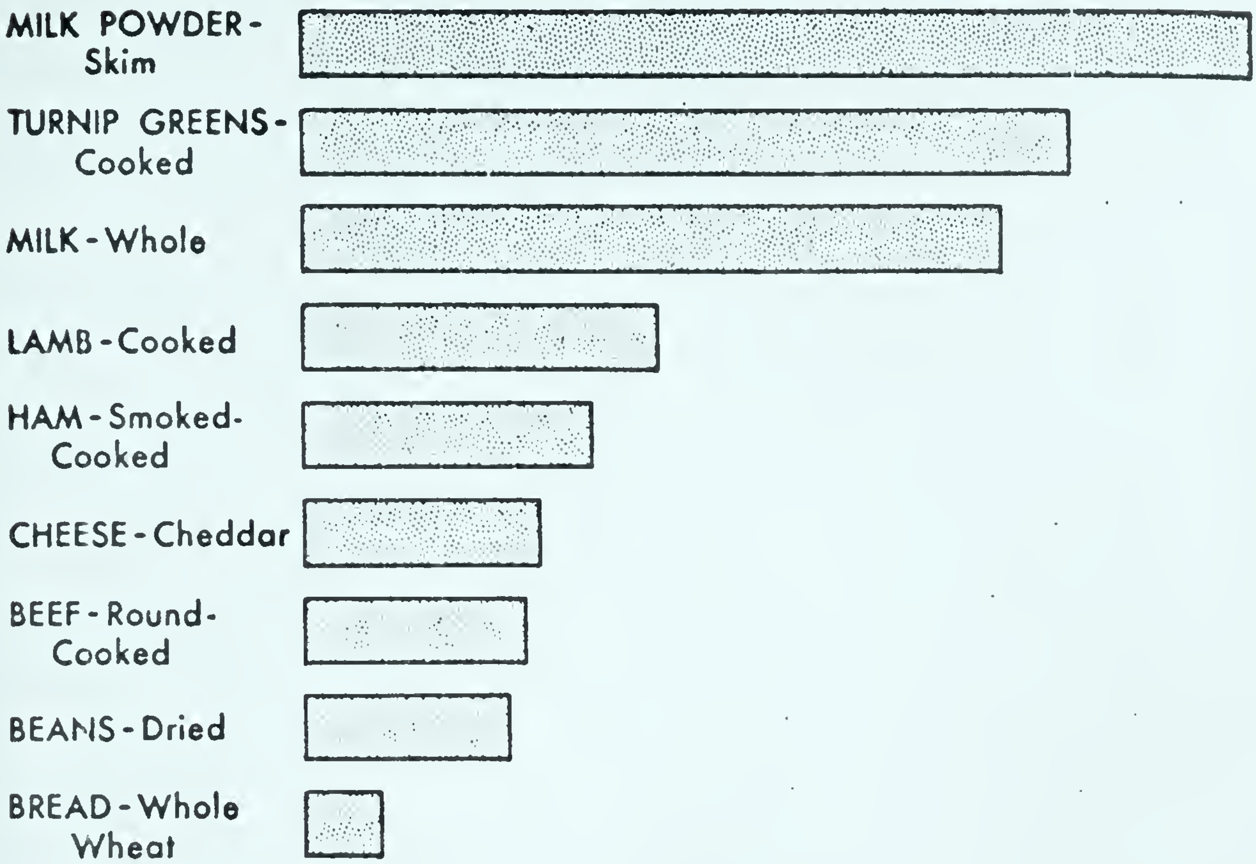
Riboflavin, one of the B-complex vitamins, must be very important, judging by the fact that it is found in every living cell—at least in all the higher forms of life. A deficiency of this vitamin is widespread in the United States.

Functions of riboflavin. Riboflavin promotes growth and general health. It prolongs the active life span and is essential to nerve tissue and to cell respiration.

Deficiencies of riboflavin may give rise to digestive disturbances, impaired growth, lack of vigor, and impairment of tissue respiration.

Two groups of diseases are associated with a deficiency of riboflavin—one of the skin and the other of the eye. The skin disease may take the form of sores on the lips and face, a scaly condition around the nose and ears, and cracks in the corners of the mouth. In the eye disease caused by a deficiency of this vitamin there is a disturbance in the vision as a result of blood vessels growing into the cornea of the eye. Not only is the vision obscured in this disease, but the disturbance may lead to the formation of cataracts.

Riboflavin in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of skim milk powder—1 ounce—contains 0.56 milligrams of riboflavin.

Courtesy Bureau of Human Nutrition and Home Economics

The rat at the top, at 28 weeks, had no riboflavin. It weighed 63 grams. It became sick and lost hair—especially about the head. The picture at the bottom shows the same rat 6 weeks later, after receiving food rich in riboflavin. It now has fine fur and weighs 169 grams.

Properties of riboflavin. Riboflavin is water-soluble and therefore is likely to be lost when vegetables are drained of their water. It is also affected by light. For this reason foods containing riboflavin, such as milk, should not be exposed to light from the sun or from artificial sources. This vitamin cannot be stored in the body; so it must be included in the diet daily.

Amounts of riboflavin needed. The daily need for riboflavin increases from 0.6 milligram for children under one year of age to 2.0 milligrams for girls of fifteen and 2.5 milligrams for boys up to twenty years of age. The average adult man needs 1.8 milligrams and the average woman 1.5 milligrams.

Sources of riboflavin. Liver ranks first as a source of riboflavin, one average serving supplying a day's needs. Greens—particularly turnip greens—are also high in this vitamin. Milk, in addition to its many other valuable nutrients, contains liberal amounts of riboflavin. In fact, milk is an important source of riboflavin for vitamin pills. Lean meats are also good sources of this vitamin.

How you can meet your daily riboflavin needs. The requirements for riboflavin for individuals of high school age and adults ranges from 1.5 to 2.5 milligrams per day. Common foods in the diet can supply these needs—as is illustrated by the following foods included in the three meals for one of the day's menus listed on page 383:

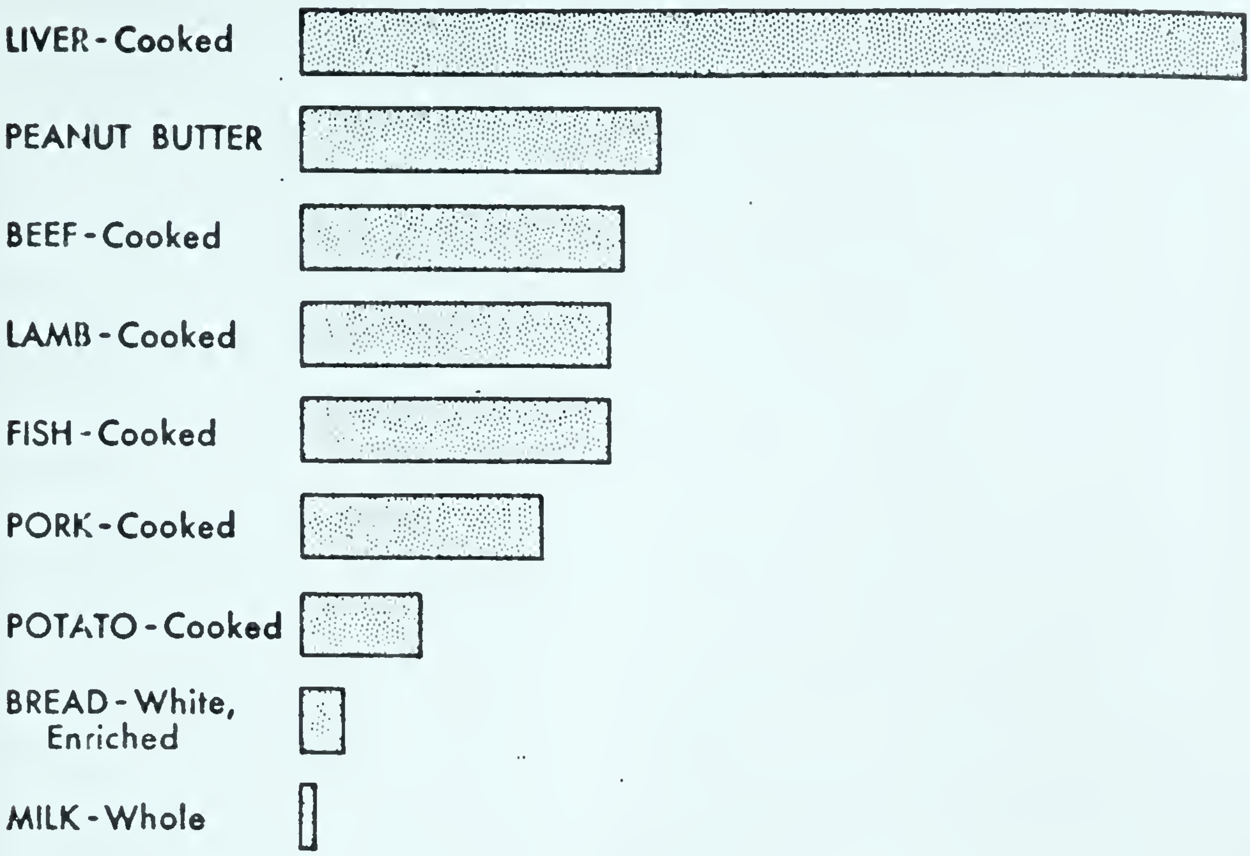
3 glasses of milk	1.26 mg
1 serving of salmon loaf	.19 mg
4 slices of enriched or whole-wheat bread	.12 mg
½ C green peas—cooked	.11 mg
1 egg	.15 mg
Total	1.83 mg

Most of the other foods in that day's menu contain small amounts of riboflavin. Another glass of milk would make it possible for the higher requirements of 2.5 milligrams to be met.

Niacin—The Antipellagra Vitamin

Niacin, although a member of the B group, has never been given a number. It was formerly called "nicotinic acid." This

Niacin in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of fresh, cooked liver—3½ ounces—contains 12.9 milligrams of niacin.

acid has been a chemical laboratory item since 1867, but only recently was it recognized as being the same chemical as niacin.

Functions of niacin. Niacin promotes growth and health. It helps to maintain the normal functions of the digestive tract and of the skin.

Niacin deficiency leads to a disease called pellagra—meaning rough skin—which formerly was thought to be limited to the states in the South. However, we now know that it exists throughout the United States. It is likely to be found among people with low incomes and among alcoholics. In pellagra the functions of the digestive system are affected. There is a loss of appetite and poor utilization of food. The mouth becomes sore and the skin is affected. Pellagra can be prevented entirely by the inclusion of an adequate amount of niacin in the diet.

There are many people in this country who, although they do not have pellagra, have symptoms to indicate that they are suffering from partial deficiencies of niacin. These symptoms are red

tongue, roughness of skin, indigestion, and weakness. Sometimes a lack of niacin produces an acute mental condition characterized by a state of confusion and disorientation.

In dogs, a deficiency of niacin produces a disease known as black tongue.

Amounts of niacin needed. The amount of niacin required daily increases from 4 milligrams for children under one year of age to 13 milligrams for girls of fifteen and 17 milligrams for boys up to twenty years of age. The average man needs 15 milligrams and the average woman needs 12 milligrams. As with thiamine, the amount of niacin needed is increased with an increased consumption of carbohydrates and during pregnancy and nursing.

Properties of niacin. Niacin is stable to air, light, and heat and so is not destroyed in ordinary cooking processes. However, like other B vitamins, it is soluble in water, especially hot water. Therefore, cooking procedures should be such as to keep the loss of niacin to a minimum. This vitamin must be included in the diet daily, since it is not stored in the body.

Sources of niacin. Foods from animals are the principal sources of niacin, with liver again ranking first. Peanut butter is an excellent source, equal to liver on the basis of equal weights. Potatoes, beans, soybeans, and enriched grain products are fair sources.

How you can meet your daily niacin needs. The daily menu must be planned to furnish niacin requirements ranging from 12 to 17 milligrams for youth and adults. How this range of needs can be met is illustrated by the following combination of foods selected from one of the day's menus listed on page 383:

1 serving of liver	11.6 mg
4 slices of whole-wheat bread	2.8 mg
1 serving of potatoes	1.0 mg
1 serving of corn-meal mush	1.1 mg
1 serving of veal	2.1 mg
Total	18.6 mg

Lean meats, poultry, and fish can take the place of liver, although their niacin content is not as high.

Vitamin C—The Antiscurvy Vitamin

Vitamin C is known as the antiscurvy vitamin. Its chemical name is ascorbic acid.

This vitamin is of historical interest. For several hundred years, when seafaring men and explorers went on extended trips, they could make no provision for a sufficiently varied diet. Because of the lack of fresh fruits, vegetables, and meat in their diets, they developed the vitamin C deficiency disease—scurvy.

Here is a typical account of a sailing trip written many years ago.

> The sailor's usual diet consists of salt pork, molasses, hard tack, and sometimes cheese. These are foods which are able to keep well on long ocean trips.
>
> After many weeks at sea on such a limited diet, the men first complain of being tired. Then their legs begin to swell and their joints ache as if they had rheumatism. Their bodies bruise easily and purple blotches appear where they have been bruised. The gums bleed and in time their teeth become loose. The sailors become depressed and quarrelsome. By now some sailors are dying, others are unable to help with the work, and the ship is being left without an adequate crew.

The British Navy began in 1745 to give its men lime juice—actually lemon juice—to prevent scurvy. From this custom arose the nickname "limy" for British sailors.

Scurvy still exists in various parts of the world, but it is usually not so severe as it was in earlier times, since fresh fruits and vegetables are now more commonly included in everyone's diet.

Functions of vitamin C. Vitamin C is important in tooth formation, bone formation and repair, the production of bone salts, the formation of callus in the union of fractured bones, and in wound healing. Several of these functions are explained by the fact that vitamin C is necessary for the formation of intercellular substance—the "cement" between the cells.

Tests which have been developed to discover the amount of vitamin C in the body fluids indicate that there is a deficiency of this vitamin in many American diets. Some of the information about the adequacy of vitamin C in the diets of the various

groups discussed in Chapter 3 was obtained by means of such tests.

Insufficient vitamin C in the diet may show itself in various ways. The gums may become soft and tender and bleed easily. Wounds and cuts are slow to heal. The skin bruises easily. The body is less resistant to disease and infection. Joints become swollen and tender. There may be certain signs of "old age."

Properties of vitamin C. Vitamin C in food is easily destroyed or lost. It is water-soluble, and therefore the water in which vegetables are cooked may contain a considerable part of the amount originally present in the vegetable.

Vitamin C is fairly stable in acid solutions but sensitive to alkalies. Therefore, baking soda should not be added to foods to help retain their color or to hasten the cooking process.

Furthermore, vitamin C is easily oxidized and therefore air—oxygen—should be kept away from foods which have had their protective coverings ruptured. For instance, an appreciable loss of this vitamin occurs when orange juice is allowed to stand at room temperature. If fruit juices must be prepared in advance, it is well that the container be filled to the top, stoppered, and put in the refrigerator. All foods high in vitamin C should be kept as cool as possible. Experiments have shown that spinach, for example, if allowed to stand for 24 hours at room temperature, will lose one-third of its vitamin C.

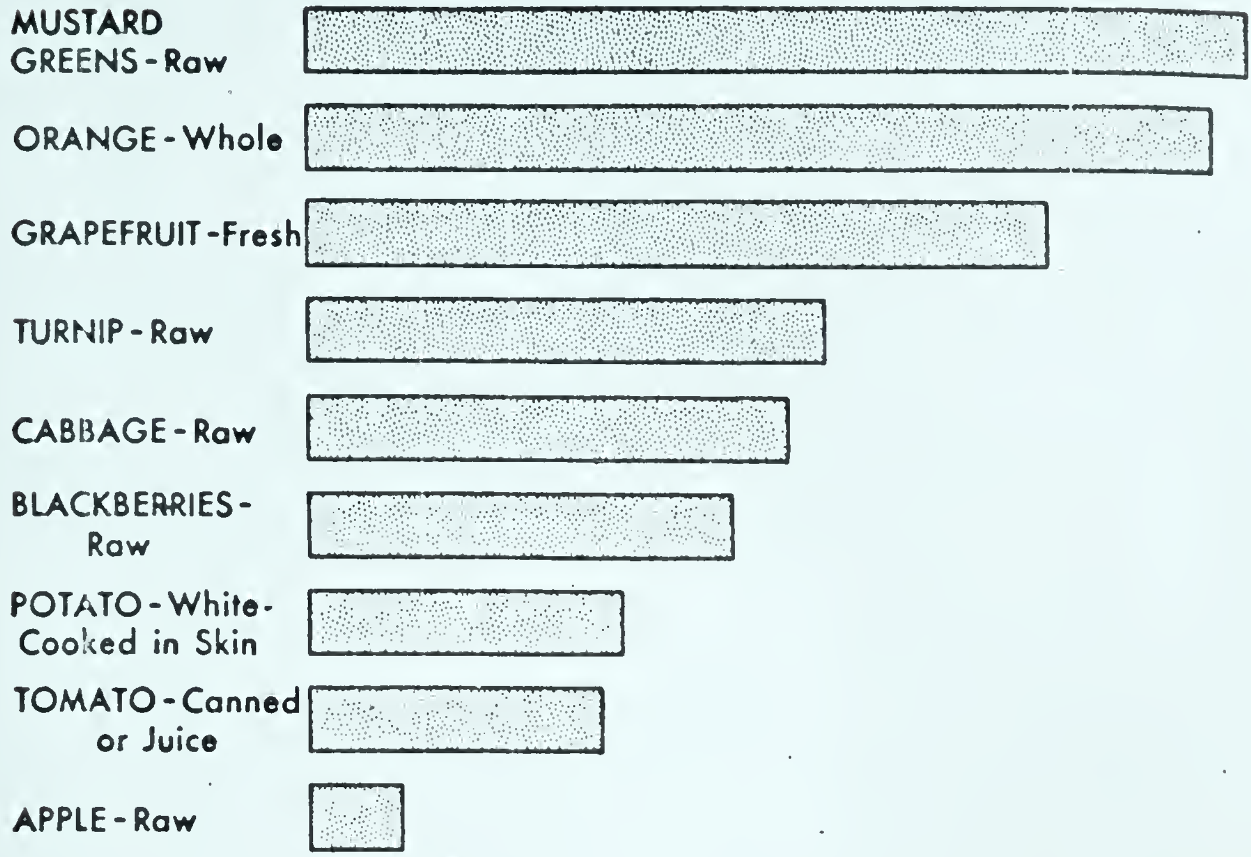
To conserve the vitamin-C content of foods, avoid cutting foods until necessary, cook with a minimum of water, and cover with a lid. The use of a pressure cooker is recommended for cooking vegetables, since less vitamin C is lost by this method.

We need to eat foods containing vitamin C daily, since our bodies are unable to store this vitamin.

Amounts of vitamin C needed. Children need daily from 30 milligrams of vitamin C at the age of one, to 80 for girls of twenty years and 100 for boys of twenty years. The average man needs 75 milligrams and the average woman requires 70.

It is believed that scurvy did not afflict infants until bottle feeding was practiced, since human milk contains vitamin C, whereas pasteurized or boiled cow's milk does not. Therefore,

Vitamin C in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of raw mustard greens—½ cup chopped or 100 grams—contains 102 milligrams of vitamin C or ascorbic acid.

small infants who are dependent upon pasteurized cow's milk must have some other source for their vitamin C. Orange juice is commonly included in their diet for this reason.

Sources of vitamin C. There are many sources of vitamin C, but the important and reliable ones in this country are the citrus fruits—oranges, grapefruit, lemons, and tangerines—and tomatoes. It is also found in important amounts in fresh strawberries, mustard greens, raw cabbage, green peppers, and in fair amounts in most other fresh, raw fruits and vegetables including potatoes.

It is important that you compare the amounts of vitamin C found in various quantities of foods and take into consideration their relative costs. For example, it takes at least twice as much tomato juice as orange juice to supply the same amount of this vitamin. It also takes four to five times as much pineapple juice as grapefruit juice. Study Table 10 in Appendix A for a com-

Courtesy Bureau of Human Nutrition and Home Economics

The guinea pig at the top, which had no vitamin C, developed scurvy. Its crouched position is caused by sore joints. The other guinea pig, which had plenty of vitamin C, is healthy and alert and has sleek, fine fur.

parison of different quantities of foods needed for an equivalent amount of vitamin C.

If the entire amount of 75 milligrams recommended for the average man were to be supplied by fresh oranges, $1\frac{1}{2}$ medium-sized oranges would be required. However, other foods in the daily diet will usually contribute variable amounts, which then reduce the quantity of orange juice—or other main sources of this vitamin—that is needed.

How you can meet your daily vitamin-C needs. The principal vitamin-C foods in two of the menus listed on page 382 are here given. These foods contribute varying amounts of the vitamin toward the day's needs of 70 to 100 milligrams:

Example One

1 medium orange	49 mg
⅔ C of raw cabbage	26 mg
Total	75 mg

Example Two

½ C of tomato juice	16 mg
⅓ C of green lima beans	16 mg
¼ C of beets	2 mg
⅓ C of raw cabbage	13 mg
1 medium carrot	3 mg
2 leaves of lettuce	2 mg
1 heart of celery	4 mg
Total	56 mg

In comparing the two examples, note that the orange, as an example of a citrus fruit, makes it relatively easy to meet the requirements for vitamin C.

Vitamin D—The Sunshine Vitamin

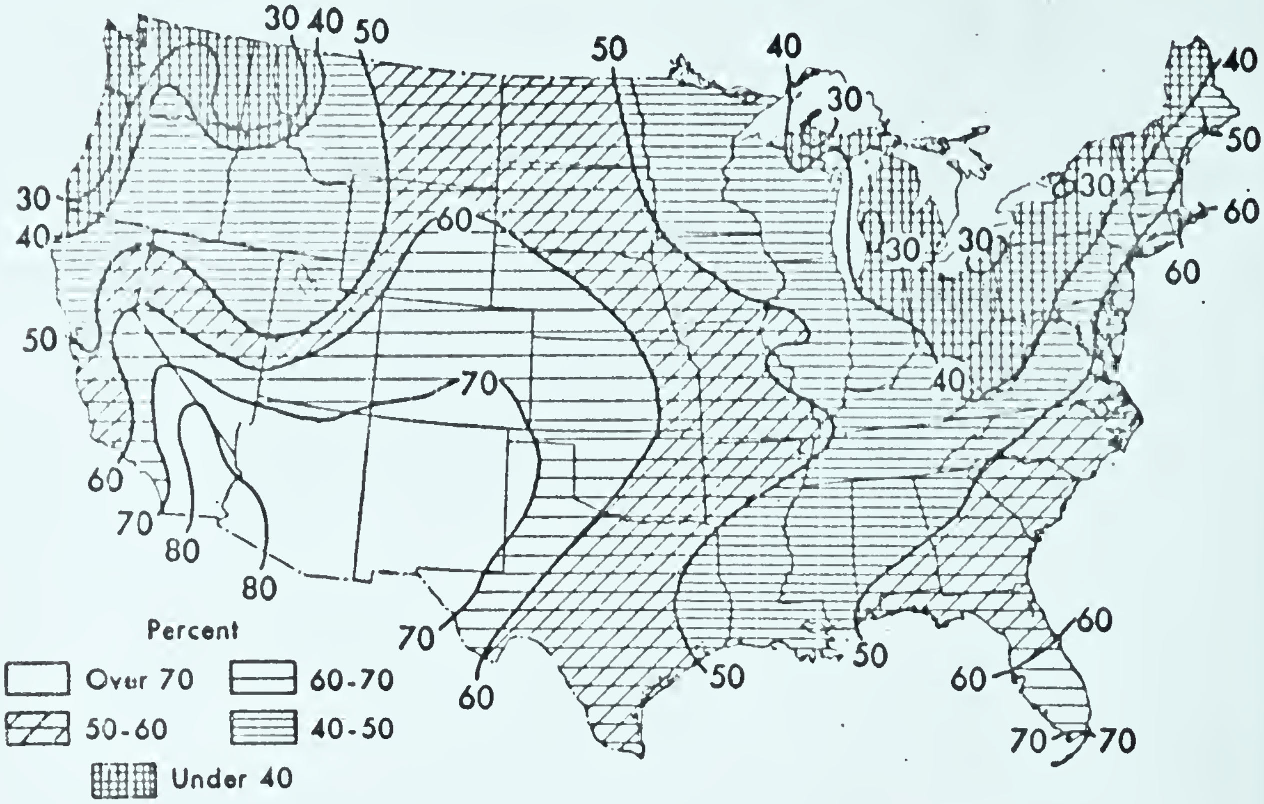
Vitamin D is known as the "sunshine vitamin" because it is supplied not only by certain foods but also from the sun.

Functions of vitamin D. Vitamin D is essential for the normal development of bones and teeth. For this reason, babies and young children need this vitamin more than adults do.

Many people have the mistaken idea that bowlegs is caused by allowing children to walk too soon. Rather, the cause is an insufficient amount of vitamin D to enable the development of sturdy bones.[5] Rickets is the technical name for such bone deformities. Other deformities of the skeleton result, such as knock-knees, enlargement of the ends of the long bones, curvature of the spine, and deformities of the pelvis and the thorax. A recent study showed that a large percentage of individuals who do not have the visible signs of vitamin-D deficiency have

[5] *Note:* Calcium, phosphorus, and vitamin C, as well as vitamin D, help to maintain normal growth of bones. A deficiency of any of these nutrients may prevent the normal growth of bones.

Regional Variations in Amount of Winter Sunshine
(Based on 200 U.S. Weather Bureau Stations, 1899–1938)



Courtesy U.S. Weather Bureau

This map shows the percentage of days of sunshine during the winter months—December–February—for various parts of the United States. During the winter months the average hours of sunshine for the entire country is 36 percent less than it is in the summer. What can people do to compensate for the lack of vitamin D when they do not have sufficient sunshine?

faulty bone development, as shown by X-ray pictures. If vitamin D is supplied after such deformities have developed, it will help to prevent further impairment but cannot restore the bones to their normal shape and structure.

Properties of vitamin D. Vitamin D, fortunately, is stable and is not soluble in water; therefore, it is not lost in cooking or by exposure to air as is the case with many of the other vitamins.

This vitamin is not made synthetically but is formed by irradiation with ultraviolet light of a chemical known as ergosterol and related chemical substances. It is available commercially as viosterol.

Sources of vitamin D. The average diet, even if it may be well balanced in other respects, is not likely to supply sufficient vitamin D. The *Journal of the American Medical Association* has stated

that "Although the diet may occasionally furnish appreciable amounts of vitamin D, most of the time it furnishes none. The only proper attitude is to regard the diet as being completely devoid of the vitamin." It is therefore very essential that babies and young children have included in their daily diets some vitamin D concentrate, such as cod-liver oil.

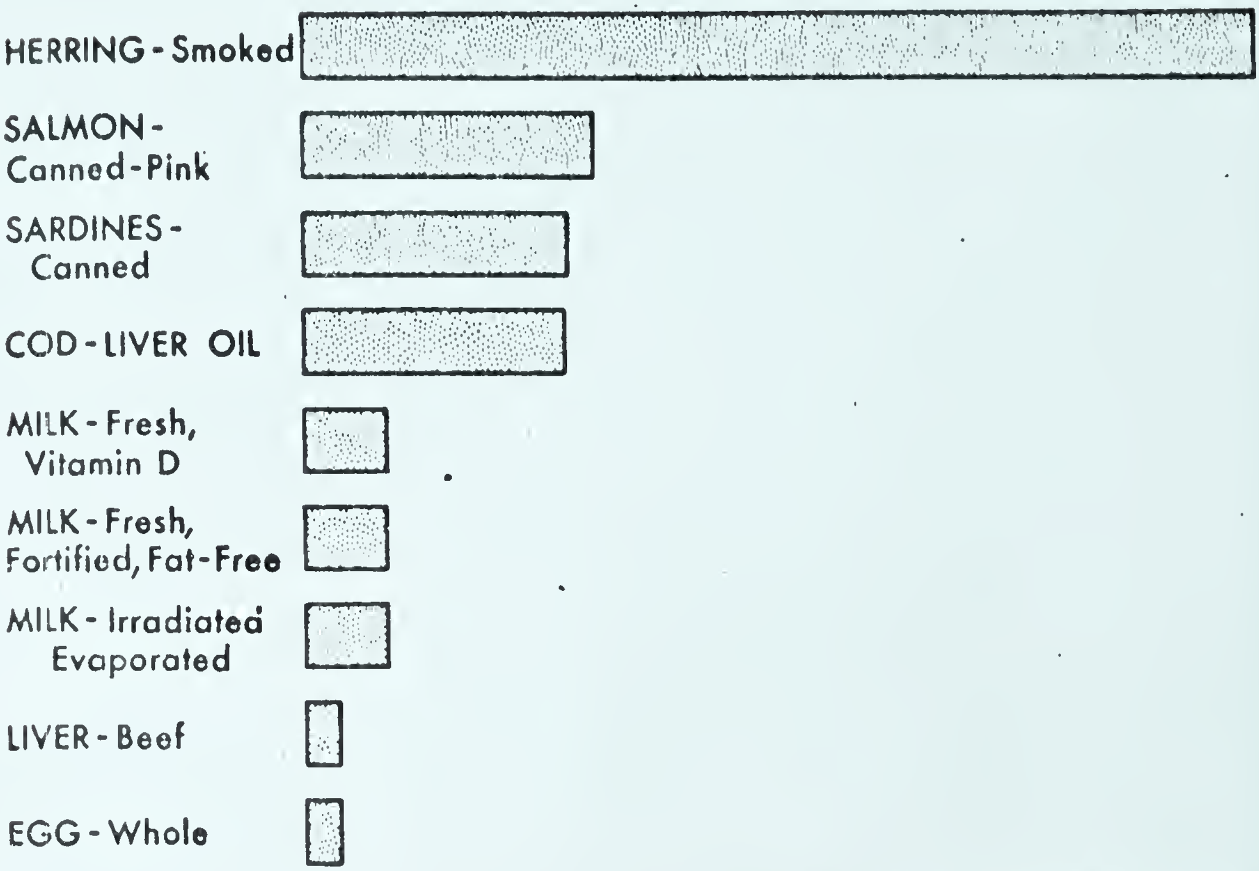
From sunlight. When the sun shines on our skin, vitamin D is formed. The skin contains a substance known as cholesterol, which is converted into vitamin D when exposed to ultraviolet rays. Sunlight contains these rays. Sometimes these rays are referred to as chemical, or actinic, rays in contrast to those rays which supply light and others which supply heat. It is the ultraviolet rays which develop the photographic films. They are invisible, and their presence is known only by the effects which they produce, such as tanning the skin.

Under certain circumstances, the supply of sunlight to which we may be exposed is inadequate. In the wintertime we are less likely to be outdoors, and even when we are, little of our skin is exposed to the sun. Smoke, fog, and cloudy weather reduce the amount of ultraviolet rays which reach our bodies. Many people have occupations which keep them from obtaining direct sunlight. Miners, factory workers, school children, office workers, and numbers of others are unlikely to get sufficient vitamin D from the sun unless they make special effort to be outdoors in their free time.

Light-skinned people, if careless in their exposure to sunlight, are more likely to suffer from sunburn than those who are more dark-complexioned. They need not expose themselves so long to get the same benefits. An excessive tan reduces the benefit that may be obtained from the ultraviolet light; so discretion is desirable in this respect as well.

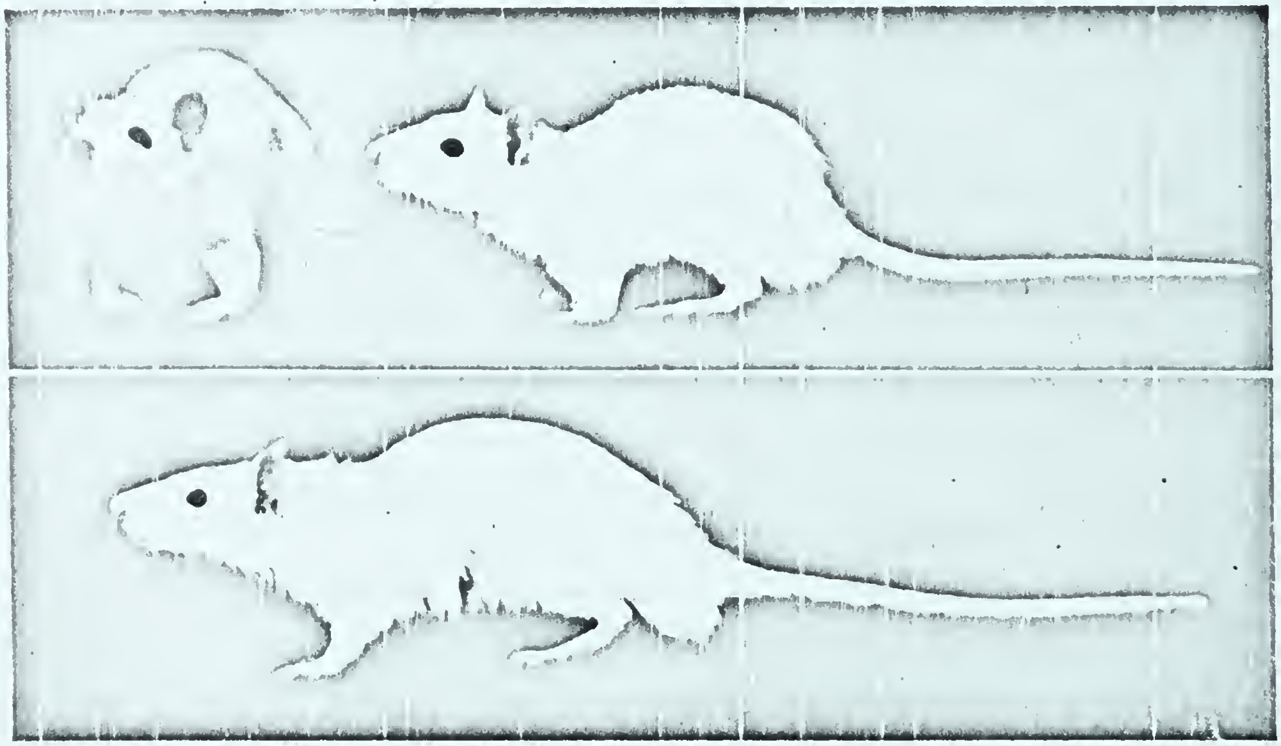
The pigment in the skin of dark-skinned people reduces the amount of ultraviolet rays which enters their skin. Nature has given them this protection for living in tropical regions where a little sunlight will be sufficient to supply them with their daily needs. The sun's rays near the equator are stronger than in areas farther away. Consequently, when dark-skinned people move to

Vitamin D in Average Servings of Common Foods*



Courtesy Philadelphia Child Health Society

* One average serving of smoked herring—2 ounces or 60 grams—contains 1,140 units of vitamin D.



Courtesy Bureau of Human Nutrition and Home Economics

The rat at the top had no vitamin D. Its poorly shaped body and bowlegs are typical signs of rickets. The other rat, which had plenty of vitamin D, has grown to normal size and has bones that are strong and straight.

temperate and northern climates, they will not receive the same amount of benefit from sunlight as those with lighter skin. For this reason, dark-skinned people are more likely to develop rickets when young unless they receive vitamin D from other sources.

Certain types of sun lamps are available which supply ultraviolet rays. Such lamps can substitute for the sun and are in use in hospitals, schools, industrial plants, and homes if used with precaution. Other lamps supply heat or just light and should not be confused with the ultraviolet-ray type.

From food. Many kinds of fish have the ability to store up appreciable quantities of vitamin D, as well as vitamin A, in their livers. The liver oils of the halibut, shark, and perch are even richer sources than cod-liver oil.

Plants do not supply vitamin D. This fact adds to the difficulty of supplying enough of the vitamin through the diet. Vitamin D is found only in foods of animal origin. Important amounts of this vitamin are contributed by herring, mackerel, tuna, and salmon.

Whole milk, cream, and butter have some vitamin D present, provided that the cows from which these products are obtained have been grazing outdoors. Consequently, the vitamin-D content in these products is higher in summer than in winter. Vitamin D is added to milk by some dairies. One quart of fresh vitamin-D milk contains 400 units of this vitamin and therefore supplies the day's needs for children and youth. Milk was one of the first foods to be fortified with a vitamin. The addition of vitamin-D concentrates is the chief method by which the vitamin-D content of milk is raised. Other methods, less used today, are the irradiation of milk with ultraviolet light and the feeding of irradiated yeast to the cows. Milk is the only food approved by the American Medical Association for fortification with vitamin D.

Amounts of vitamin D needed. Children and youth up to the age of twenty need daily 400 International Units of vitamin D. Adults undoubtedly need some vitamin D when the vitamin benefits are not available from sunshine.

How you can meet your daily vitamin-D needs. As already mentioned, it is difficult to meet the vitamin-D needs from the ordinary diet. The comparative amounts of vitamin D in the more common sources of this vitamin are here given.[6] Table 10 in Appendix A does not supply this information.

Food	*Weight (gm)*	*I.U.*
Herring, smoked, 1/2 bloater	60	1,140
Mackerel, fresh, 3 1/2 oz	100	1,100
Herring, fresh, 2 oz	60	840
Tuna, 1/2 C, scant	60	600
Sardines, canned, 3 medium or 6 small	30	321
Cod-liver oil, 1 t	3.7	315
Salmon, red, oil, 1 t	3.7	315
Percomorph-liver oil, 1 drop		180
Shrimp, fresh, 5–8 large	100 before cooking	150
Milk, fresh, vitamin D, 8 oz	240	100
Milk, evaporated, irradiated, undiluted, 4 oz	120	100
Liver, beef, or pork, 3 1/2 oz	100	45
Egg, whole, 1 medium	50	45
Liver, lamb, 3 1/2 oz	100	20
Liver, calf, 3 1/2 oz	100	15
Milk, fresh, whole, 8 oz	240	5
Oysters, fresh, 4–6 medium	100	5
Butter, average, 1 square	10	4

An examination of this list will show that vitamin-D milk is ordinarily the most reliable and convenient way to meet the daily needs for this vitamin.

Other Vitamins

The six vitamins already discussed in this chapter are included in the Nutrition Yardstick because more is known about them

[6] From Anna DeP. Bowes and Charles F. Church, *Food Values of Portions Commonly Served*, Philadelphia Child Health Society, Philadelphia, 1946.

than about the others. Brief discussions are here given about a few of the other vitamins of general interest.

Vitamin K. Although it is ordinarily not important to plan diets for their vitamin-K content, we shall consider this vitamin because of certain interesting facts about it.

In 1935 a Danish scientist named Henrik Dam showed that a cure for bleeding in newly hatched chicks could not be effected by means of any of the known vitamins. He therefore concluded that the disease was caused by the absence of a hitherto unknown dietary factor for which he suggested the Danish name "Koagulations Vitamin," and so the substance needed for causing blood to coagulate became known simply as vitamin K.

Originally a vitamin-K deficiency could be produced experimentally only in chicks and other fowls. Attempts to induce the disease of bleeding in mammals by restricting the vitamin K in the diet failed. This was interpreted as possibly being due to the ability of mammals to synthesize all their vitamin-K needs in their own intestinal tract. It is now known that this vitamin is synthesized by bacteria found in the human intestine. Consequently, vitamin-K deficiency is usually not a dietary problem in man.

The specific function of vitamin K is to make possible the production of prothrombin in the blood. Prothrombin is necessary for the clotting of blood.

It is known that the low prothrombin reserve in the blood of babies a few days old is due to a deficiency of vitamin K. Newborn infants are therefore likely to bleed more readily. This condition is now explained by the fact that at birth the intestinal tract of the infant is sterile—there are no bacteria present as yet. So vitamin K cannot be synthesized until bacteria get into the intestine, which takes a few weeks.

Vitamin K is supplied to individuals before they are operated on in order to supplement the supply naturally found in the body.

The important natural sources of vitamin K are the leafy green portions of alfalfa, spinach, cabbage, kale, cauliflower, and the like. This vitamin is now made synthetically in the form of several different but related types of chemical compounds.

Vitamin E. Vitamin E is known as the antisterility vitamin. It is necessary for normal reproduction in many animal species. However, its significance in human nutrition in relation to reproduction is not definitely known.

Vitamin E is an antioxidant which preserves the vitamins which are easily oxidizable. It may act as a regulator of the metabolism of the cell nucleus.

The richest source of vitamin E is wheat-germ oil. Other good sources are corn oil, soy oil, peanut oil, and wheat germ.

Pantothenic acid. Pantothenic acid—a B vitamin—is known as the anti-gray-hair factor. It is essential for all living organisms including man. Pantothenic acid is related to the utilization of other vitamins, especially riboflavin. It is necessary for the normal hatching of eggs.

Graying of the hair due to a deficiency of pantothenic acid has been observed in rats, mice, and silver foxes, but not in humans.

In animals a deficiency of the vitamin results in progressive impairment of the gait until they can't walk. In humans a deficiency results in burning hands and feet.

Pantothenic acid is found in a variety of foods. The more important ones are beef liver, dried peas, eggs, roasted peanuts, wheat bran, beef heart, wheat germ, and broccoli.

Folic acid. The B vitamin known as folic acid is used in the treatment of certain types of anemia and of sprue. It is essential for the normal metabolism of growing cells and tissues. It is required for growth and blood formation in chicks, monkeys, fox, and mink.

Folic acid is found in a number of foods, of which the more important are salmon, beef liver, dried lima beans, wheat germ, roasted peanuts, spinach, oysters, and chicken.

For Review

1. Define the following terms: (*a*) night blindness, (*b*) carotene, (*c*) pellagra, (*d*) scurvy, (*e*) beriberi, (*f*) rickets, (*g*) prothrombin, and (*h*) folic acid.
2. Discuss the following vitamins in regard to their functions and the

effects of deficiencies in the diet: (*a*) vitamin A, (*b*) thiamine, (*c*) riboflavin, (*d*) niacin, (*e*) vitamin C, and (*f*) vitamin D.

3. In what amounts are each of the six important vitamins needed for a person your age?
4. What are important sources of each of the six vitamins?
5. An increase in the amount of physical activity steps up the need for which two of the vitamins?
6. Discuss the relationship of sunshine to vitamin-D needs.
7. How can vitamin D be added to some foods?
8. Compare the vitamin needs of children with those of adults.
9. What are the vitamin needs of expectant and nursing mothers?
10. Which vitamins can be synthesized in the body?

For Personal Application

1. Prepare a table on vitamins using five columns with the following headings: name of vitamin, functions, amount needed, main sources, and other good sources.
2. Analyze one or more of your day's diets for vitamin content. In which vitamins, if any, is your diet deficient? What additions or changes in your diet would make it better balanced?
3. Turn to Table 10 (page 310) and study the vitamin-C value of an orange, grapefruit, tomato, and pineapple. Compare the costs of equal amounts of their juices on the basis of prevailing food prices. Which supplies most vitamin C for the money expended?
4. Name five foods that are excellent sources of two or more vitamins. Use the information given in Table 10 for this problem. To what extent are these foods included in your diet?
5. Examine the analyzed menus in Appendix B for their vitamin content. How would you improve on the poor menus? What substitutions could be made in the well-balanced menus without lowering the vitamin content?
6. Study the milk supply of your community and school. Is the school serving vitamin-D milk to its students? If not, could you discuss this with your principal or dietitian?
7. Check on the preparation of the vegetables in your home. Are the vitamins being saved or lost?
8. Ask the chemistry teacher, or the company from which the school buys biological supplies, to furnish the class with vitamin crystals—each in a separate bottle. Have the class examine them.

10

THERE ARE SEVEN BASIC FOOD GROUPS

> The program of nutritional enrichment of staple foods, particularly flour, bread, corn products and possibly rice, gives indication of accomplishing promptly one of the greatest nutritional benefits of all times.
>
> FRANK L. GUNDERSON[1]

So far we have discussed the value to the individual of the essential nutrients—why they are needed, what they do, and how much of each is required. Now we shall consider the more practical applications of this information by discussing the food groups which contain the necessary nutrients—that is, the Basic Seven Food Groups (see Chapter 2). The Basic Seven Food Groups were developed in order to make the requirements of the Nutrition Yardstick easier to apply. Turn again to the chart of these groups on page 31 and review it as a background for the information in this chapter.

The foods within each of the Basic Seven Food Groups supply some special needs not so well met by the foods listed in the other

[1] Former Executive Secretary, Food and Nutrition Board, National Research Council.

TABLE 5

Principal Nutrients Supplied by Each of the Basic Seven Food Groups
(*Legend:* xx indicates an important source; x indicates a good source)

Food group	Nutrients									
	Food energy	Protein	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic acid	Vitamin D
1. Green and yellow vegetables			x	x	xx	x	x		x	
2. Citrus fruits, tomatoes, raw cabbage					x	x			xx	
3. Potatoes, other vegetables, and fruits	x			x		x			x	
4. Milk and milk products (fluid, dried, evaporated)	x	xx	xx		x	x	xx			
5. Meat, poultry, fish, eggs, dried beans, peas, nuts	x	xx		x		x	x	x		
6. Bread, flour, cereal (whole-grain, enriched, or restored)	xx	x		x		x	x	x		
7. Butter and fortified margarine	xx				x					

Note: Individual foods within a group may vary somewhat from the group average. The information in the above table is based on the recommended number of servings for each group per day as discussed elsewhere in this chapter, rather than on a comparison of equal weights.

groups. There is such a wide variety of choice within each group that it should be possible to find several foods in each one which are available on the market and which also are to your liking. Table 5 shows the nutrients of which each group is an important source. Every individual should include daily in his diet some food from each of the seven groups—the number of servings needed being stated in connection with the listing of the respective groups.

Group 1

The foods in Group 1 are the chief sources of vitamin A. The most common foods in this group are as follows:

Group 1. Leafy, green, and yellow vegetables (raw, cooked, frozen, canned)

One or More Servings Daily

Asparagus, green	Collards	Peppers, green and red
Beans, lima	Endive, green	Pumpkins
Beans, snap, green	Escarole	Spinach
Broccoli	Kale	Squash, winter yellow
Brussels sprouts	Lettuce, leaf	Sweetpotatoes
Cabbage, green	Mustard greens	Turnip greens
Carrots	Okra	Wild greens
Chard	Peas, green	Other greens, including salad greens

In addition to these common foods, the following edible plants that grow wild also are good sources of vitamin A and belong in Group 1: dandelions, water cress, winter cress, sorrel, dock, pokeweed, chicory, cowslip, summer mustard, lamb's-quarters, nettles, and milkweed. Consult a flower guide for pictures of these plants. These greens should be prepared in the same way as the more common ones. They are best eaten when young; the mature plants often are tough and bitter.

Each day, at least one large serving from the foods in Group 1 should be included in the diet in order to supply vitamin A. The

Courtesy U.S. Dept. of Agriculture

Many school and community groups all over the country—such as the 4-H Clubs, the Future Farmers of America, and the Future Homemakers of America—have garden projects which help to supply their families with fresh vegetables, rich in vitamins and minerals.

dark green, leafy vegetables are the richest sources of vitamin A. The foods in this group also supply liberal amounts of minerals and some other vitamins. (See Table 10 in Appendix A for mineral and vitamin content of Group 1 foods.)

Green and yellow vegetables are easily raised; therefore, when gardens are planned, space should be allowed for ample quantities of the vegetables in this group.

During the time of the year when they are abundant, you should eat large quantities of the green and yellow vegetables because the vitamin-A value which they contain, and which your body derives from these foods, can be stored in your body for later use.

If it should not be possible to include foods from this group in the diet on any particular day, it is suggested that more of the foods in Groups 2, 4, and 7 be eaten, since they are also good sources of vitamin A, although that is not their primary contribution.

Group 2

Foods which are high in vitamin C make up Group 2. The most common foods included in this group follow:

Group 2. Citrus fruits, tomatoes, raw cabbage, and other high vitamin-C foods

One or More Servings Daily

Grapefruit	Cantaloupes (muskmelons)
Grapefruit juice	Pineapples, raw
Kumquats	Strawberries, raw
Lemons	
Limes	A large serving of the following vegetables can be substituted for the fruits in this group:
Oranges	
Orange juice	
Tangerines	Cabbage, raw
	Greens, salad
Tomatoes	Peppers, green, raw
Tomato juice	Turnips, raw

The citrus fruits, tomatoes, raw cabbage, and raw salad greens are the chief sources of vitamin C. Cantaloupes and strawberries are other good sources.

Oranges supply about three-fourths of the world's citrus fruits eaten, and most of it in this country is used for, and sold as, fresh fruit.

The United States produces about 97 percent of the world's supply of grapefruit, and over half of the annual grapefruit crop is canned as fruit or juice.

While vitamin C is more likely to be present in raw, uncooked, fresh foods, modern

Courtesy U.S. Dept. of Agriculture

The United States produces most of the world's supply of grapefruit, which, like all other citrus fruits, is rich in ascorbic acid, or vitamin C.

methods of commercial canning and freezing of citrus fruits retain an appreciable amount of the vitamin-C content of the fresh product. Canned tomatoes are also a good source of vitamin C if canned under the right conditions.

When foods in Group 2 are not readily available, the raw foods in Groups 1 and 3, which are fair sources of vitamin C, can be used.

Group 3

Group 3 contains foods which supplement the first two groups; in fact, it includes all other fruits and vegetables not in Groups 1 and 2. Most of the foods in this group are not high in any specific nutrient, but they may be important sources of various nutrients because of the quantities in which they are eaten. For example, an apple and a potato contain only small amounts of vitamin C, but since we may eat apples and potatoes in large amounts, their contribution of vitamin C becomes significant. The main sources of the foods in Group 3 are as follows:

Group 3. Potatoes and other vegetables and fruit (raw, cooked, frozen, canned, dried)

Two or More Servings Daily

Potatoes
Sweetpotatoes

Artichokes
Beets
Cabbage, white
Cauliflower
Celery
Corn, sweet
Cucumbers
Eggplant
Leeks
Lettuce, head
Mushrooms
Onions
Parsnips
Radishes
Rutabagas
Salsify, or oyster plant
Sauerkraut
Squash, summer
Turnips

Apples
Apricots
Avocados
Bananas
Berries
Cherries
Cranberries
Currants
Dates
Figs
Grapes
Peaches
Persimmons
Pineapple, canned
Pineapple juice, canned
Plums
Prunes
Raisins
Rhubarb
Watermelons

In this group also belong all other vegetables and fruits not listed elsewhere.

In general, these fruits and vegetables should be eaten in more liberal amounts in order to aid the work done by foods in Groups 1 and 2. They are also of help in supplementing some of the other food groups. Fruits and vegetables in general have worth-while amounts of minerals and vitamins. Consequently their inclusion in generous quantity in the daily diet is desirable.

When foods in this group are not available, it is well to include more of the foods in Groups 1 and 2 in the diet.

Group 4

Milk and milk products comprise Group 4. Milk is the only food that is given the distinction of having its own group. The reason for this position is its high content of protein, calcium, phosphorus, vitamin A, thiamine, and riboflavin.

Group 4. Milk, cheese, and ice cream (milk may be whole, skimmed, evaporated, condensed, dried, or buttermilk)

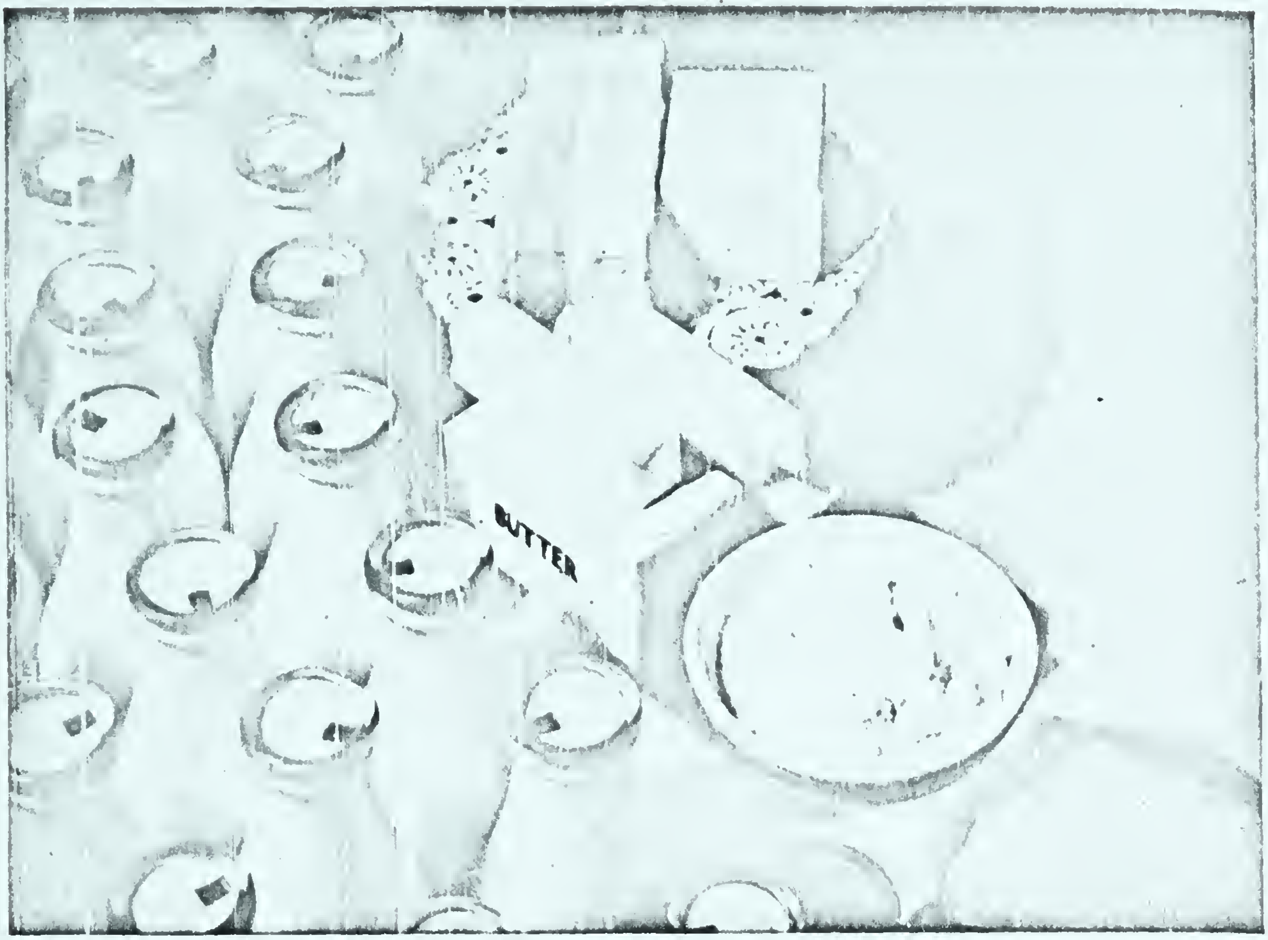
Daily Amounts for Different People

Children: 3 to 4 cups
Teen-agers: 3 to 4 cups
Adults: 2 or more cups
Pregnant women: At least 1 quart
Nursing mothers: About 1½ quarts

On the basis of calcium content, the following may be used as alternates for 1 cup of milk:

Cheddar-type cheese: 1 ounce
Cream-type cheese: 4 ounces
Cottage cheese: 12 ounces
Ice cream: 2 to 3 large dips

Milk is the only food which nature has specifically intended for the feeding of young infants. Consequently, milk is one of our most important foods. It is superior to any other foods as a source of calcium and phosphorus for bone building. It is an inexpensive



Courtesy U.S. Dept. of Agriculture

Milk and all milk products except butter make up Group 4 of the Basic Seven Food Groups. To which group does butter belong?

source of protein of high quality and therefore helps to meet the needs supplied by Group 5. Milk is a cheap source of energy—the average quart of whole milk containing about 670 calories. It is an excellent source of vitamin A and the most important source of riboflavin. Contrary to the belief held by some people, milk is easily digested.

For these reasons, milk is essential to everyone throughout his lifetime. It should be both the first food to be put into the diet and the last to be taken out. It is recommended that children and young people up to the age of eighteen have a quart of milk or its equivalent in milk products daily and that adults have at least a pint daily.

Table 6 gives the amounts of the various nutrients contained in one quart of milk and shows what percentage of the day's needs can be supplied by it.

The less money there is for food, the more essential it is that milk be included in the menu planning. The family which has 5

quarts of milk a week for each of its members is very likely to have a nutritionally satisfactory diet. The most economical and efficient way to complete and balance a daily diet which contains mainly cereals and vegetables is by a liberal use of milk and milk products.

The following amounts of the various milk products are of about equal food value to that of *one quart of fluid whole milk:*

17 ounces evaporated milk (1 tall can yields 14½ ounces)
5 ounces American cheese
4½ ounces dried whole milk
3½ ounces dried skim milk, plus 1½ ounces (3 level tablespoons) butter

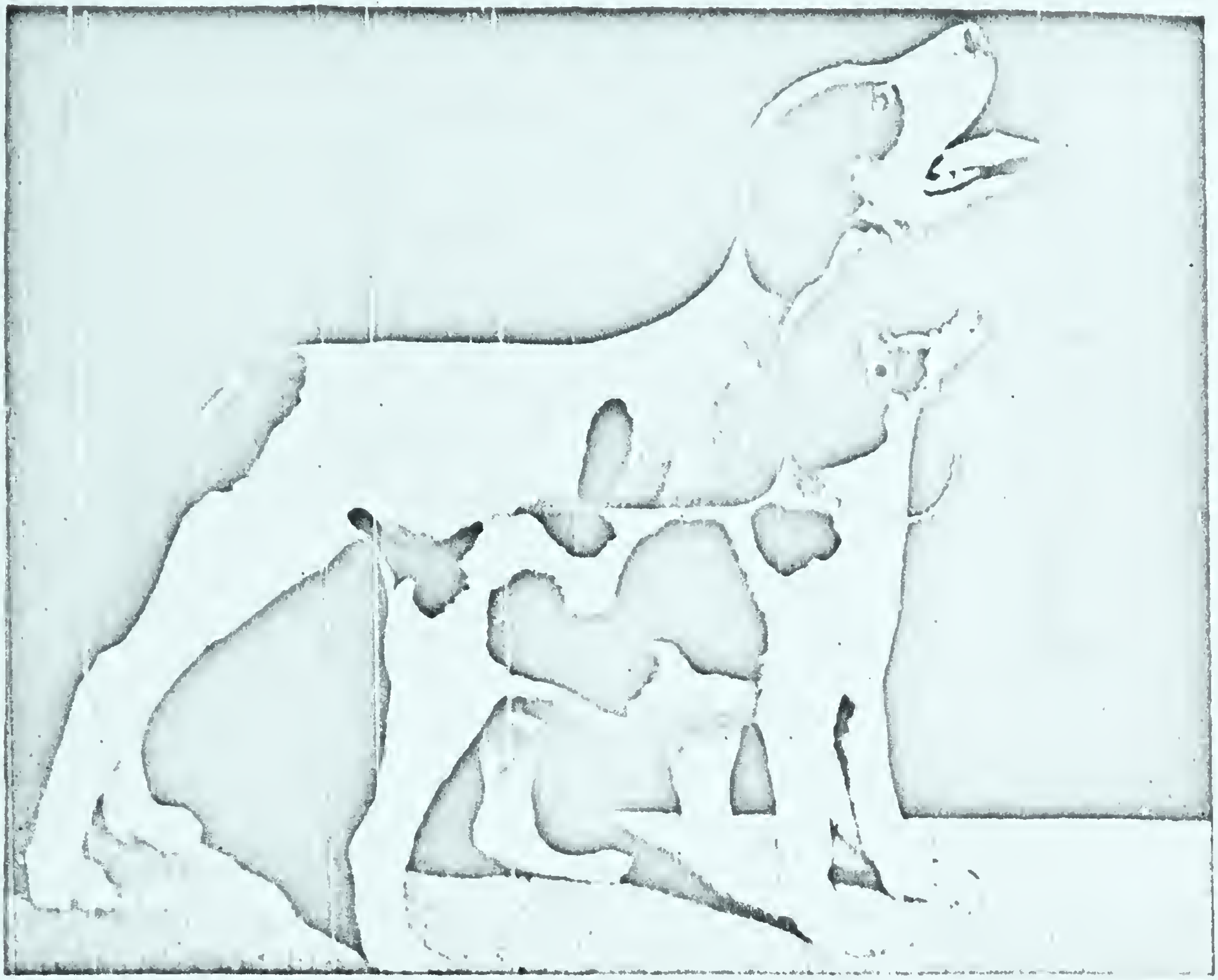
These possible substitutions should be made when whole milk is not available or when the question of cost of fresh milk needs to be considered.

Fresh milk should be bought for drinking. Evaporated milk in large cans is the cheapest for cooking. Buttermilk and skim milk are good buys when available at reasonable prices. Commercially sold chocolate milk and chocolate milk drinks are not so good for

TABLE 6

What a Quart of Milk Contributes to a Day's Needs

Nutrient	*Amount in one quart of milk (2.15 lb; 975 gm)*	*Percentage of day's needs supplied*				
		Child (4–6)	*Girl (13–15)*	*Boy (16–20)*	*Woman (moderately active)*	*Man (physically active)*
Food energy...	670 cal	42	26	18	28	22
Protein........	34.2 gm	68	43	34	57	49
Calcium.......	1,152 mg	115	89	82	115	115
Phosphorus.....	907 mg	76	76	69	69	69
Iron...........	0.6 mg	8	4	4	5	5
Vitamin A......	1,550 I.U.	62	31	26	31	31
Thiamine.......	.34 mg	43	26	20	28	23
Riboflavin......	1.68 mg	140	84	67	112	93
Niacin.........	1.1 mg	14	8	6	9	7
Ascorbic acid...	13.0 mg	26	16	13	19	17



Courtesy National Dairy Council

These two dogs are the same age, but the lurger dog had milk and the other one did not. They both had as much and the same kind of all other foods.

you as plain milk because they frequently do not contain the same food values.

In addition to being consumed as a beverage, milk can be used in soups and chowders, in puddings and custards, with cereals cooked in milk, and in a variety of other ways.

Milk should be considered a *must* for those individuals who are trying to lose weight, so as to assure a more adequate diet when other foods are being cut down on or eliminated.

Milk is called "the most nearly perfect food"; yet it is low in iron, even though the iron which it contains is used very efficiently by the body. Milk is also low in roughage. Since the pasteurization of milk destroys its vitamin C, as well as bacteria, it is important that other foods supply adequate amounts of this vitamin.

If milk and milk products are scarce, foods from Group 1 may be substituted to supply vitamin A and calcium in the

diet, and foods from Group 5 may be substituted to supply protein.

That Americans—young and old—love ice cream is evidenced by the fact that the milk of more than one million cows goes annually into the manufacture of this food. Fortunately, ice cream is an excellent food. The typical proportions of ingredients in the basic mix for ice cream is about as follows: 80 percent cream and milk products, 15 percent sugar, 4.5 percent flavor, and 0.5 percent edible stabilizer. An average serving—1/6 quart—of vanilla ice cream supplies 200 calories and all the nutrients found in milk.

The U.S. Public Health Service advises the use of the following standards for grades of milk:

Grade A pasteurized—milk which has been carefully produced and properly pasteurized. Grade A milk is as safe as any milk that can be obtained.

Grade A raw and Grade A certified—raw milks which are as safe as any raw milk can practicably be made. If you buy either of these raw grades of milk, you can secure the added protection of pasteurization at home, as described on page 277.

Homogenized milk is milk in which the fat has been broken up into very small particles which stay separated and therefore remain equally distributed in the milk. The fat does not rise to the top of the bottle on standing as it does on other milk, and so homogenized milk has no "cream line." Its food value is the same as that of other milk.

Vitamin-D milk is whole milk which has been irradiated to increase its Vitamin-D content or has had a vitamin-D product added to the milk. The added food value is definitely worth the slight extra cost.

Group 5

The foods which comprise Group 5 are those which are important sources of protein. These foods are divided into two subgroups—animal sources of protein and plant sources of protein—as follows:

Group 5. Meat, poultry, fish, eggs, dried beans and peas, nuts

Animal Sources: meat, poultry, fish (fresh, canned, or cured)
One Serving Daily, If Possible

Meat, such as beef, veal, lamb, mutton, pork (except bacon and fat back)

Lunch meats, such as bologna

Fish and shellfish

Variety meats, such as liver, heart, kidney, brains, tongue, sweetbreads

Poultry, such as chicken, duck, goose, turkey

Eggs: *Four or more a week*

Plant Sources: dried beans and peas; nuts and peanut butter
Two or More Servings a Week

Dried beans	Soy flour and grits
Dried peas	Peanuts
Lentils	Peanut butter
Soybeans	Nuts of all kinds

The only other food high in protein not included in Group 5 is milk, but since milk is of such high value as a source of several nutrients, it has merited its own group. Most of these protein-rich foods also supply various vitamins and minerals. Protein foods are well liked by most people because of the flavor which they give to the meal. The extent to which milk is used in the diet correspondingly reduces the need for the foods in this group as a source of protein. The reverse statement also applies.

If the recommendations for milk are being met, then the balance of the day's needs of protein will be amply supplied if one average serving of any of the following foods in this group is included.

Meat. Meat, such as beef, veal, lamb, mutton, and pork, contains an average of one-fifth protein. It also supplies significant amounts of iron, phosphorus, niacin, thiamine, and riboflavin.

The nutritive value of meat is not determined by the cost. Many of the cheaper cuts of meat have as much food value as the more expensive cuts, provided that the fat and bone content is

not excessive. Prepared meats, such as sliced and pressed meats and sausage, and meats which have considerable amounts of bone, gristle, and fat are expensive in relation to their nutritional value. The variety meats, such as liver, kidney, and sweetbreads, are even richer in their nutrients than lean meat. Salt pork, fat back, and bacon do not contain the important nutrients found in lean meat and therefore should be counted as fat and not as meat.

Poultry. Poultry, such as chicken, turkey, and duck, has about the same protein value as meats. Therefore, it may be interchanged with meat in planning the diet or menu.

Fish. Fish also is about one-fifth protein, the figure varying with the amount of fat in the fish. Millions of people in the world depend upon fish rather than upon meat for their protein. Fish can take the place of meat as the source of protein. Salt-water fish is also an excellent source of iodine.

Eggs. Eggs do not have so high a percentage of protein as meats, but three eggs will supply about as much high-quality protein as 1/4 pound of meat. Egg yolk is also an important source of iron and vitamins A and D. Eggs can be used to supplement plant proteins.

Considering the food value they contain, eggs may be considered an economical buy even when they are selling at high prices. Grade C eggs, as well as cold storage eggs, are less expensive and just as valuable as fresh eggs. Therefore they may be used in cooking. It is recommended that adults eat at least three to four eggs per week. Children should have one egg a day if possible.

Legumes. All types of beans, peas, and lentils are called legumes. On the roots of legume plants are small nodules containing bacteria which have the unusual ability of capturing nitrogen from the air and combining it with other substances in the plant to make protein. That is why these plants enrich the soil in which they are grown.

The protein in most legumes is incomplete—that is, it is a protein that does not contain all the 10 essential amino acids. The one exception to this among legumes is the soybean, whose protein is complete or of high quality. Other nutrients usually

contained in legumes are iron and B vitamins. Legumes also have high energy value. When legumes other than soybeans are served in place of meat, extra amounts of milk, cheese, or eggs should be eaten in the day's diet.

The soybean is in so many respects the most valuable of all plant foods, and consequently the American public needs to be educated to its value and use. There are several distinct types of soy flour and grits, differing according to the amount of fat retained after processing. The protein content varies from 40 percent in the full-fat soy products to 52 percent in the low-fat or fat-free products. These percentages of protein in soybean products are higher than in any of the animal sources of protein included in Group 5.

Soybeans are important sources of the B vitamins, the fat-free types containing higher amounts. These legumes are also important sources of calcium, phosphorus, iron, and calories. The soybean now furnishes 13 percent of the country's total production of edible fats and oils. It is also the largest single protein concentrate used for feeding farm animals.

Nuts. Nuts are a fair source of incomplete protein. Nuts are high in calories, since they also contain fat. They are a fair source of vitamins. Peanuts and peanut butter are valuable sources of the B vitamins, in addition to their protein value and high calorie content.

Meat alternates. Any food other than meat that contains a fair amount of protein is called a "meat alternate." Actually the term should be "protein alternate." Poultry, fish, eggs, legumes, nuts, and milk or milk products are all meat alternates. Aside from the protein similarity, the other nutrients may vary from that of meat, depending upon which food is being considered. Meat alternates, therefore, refer primarily to protein alternates unless otherwise specified.

Group 6

Whole-grain and enriched flour, bread, and cereals are included in Group 6. These foods are high in calories and several minerals and vitamins.

Group 6. Bread, flour, and cereals (whole-grain or enriched or restored)

Some Every Day

- Breads: whole-wheat, dark rye, enriched
- Rolls or biscuits made with whole-wheat or enriched flour
- Oatmeal bread
- Crackers: enriched, whole-grain, or soy flour
- Flour: enriched, whole-wheat, or other whole-grain
- Corn meal: whole-grain or enriched
- Grits: enriched
- Cereals: whole-wheat, rolled oats, brown rice, or converted rice
- Other cereals, if whole-grain or restored

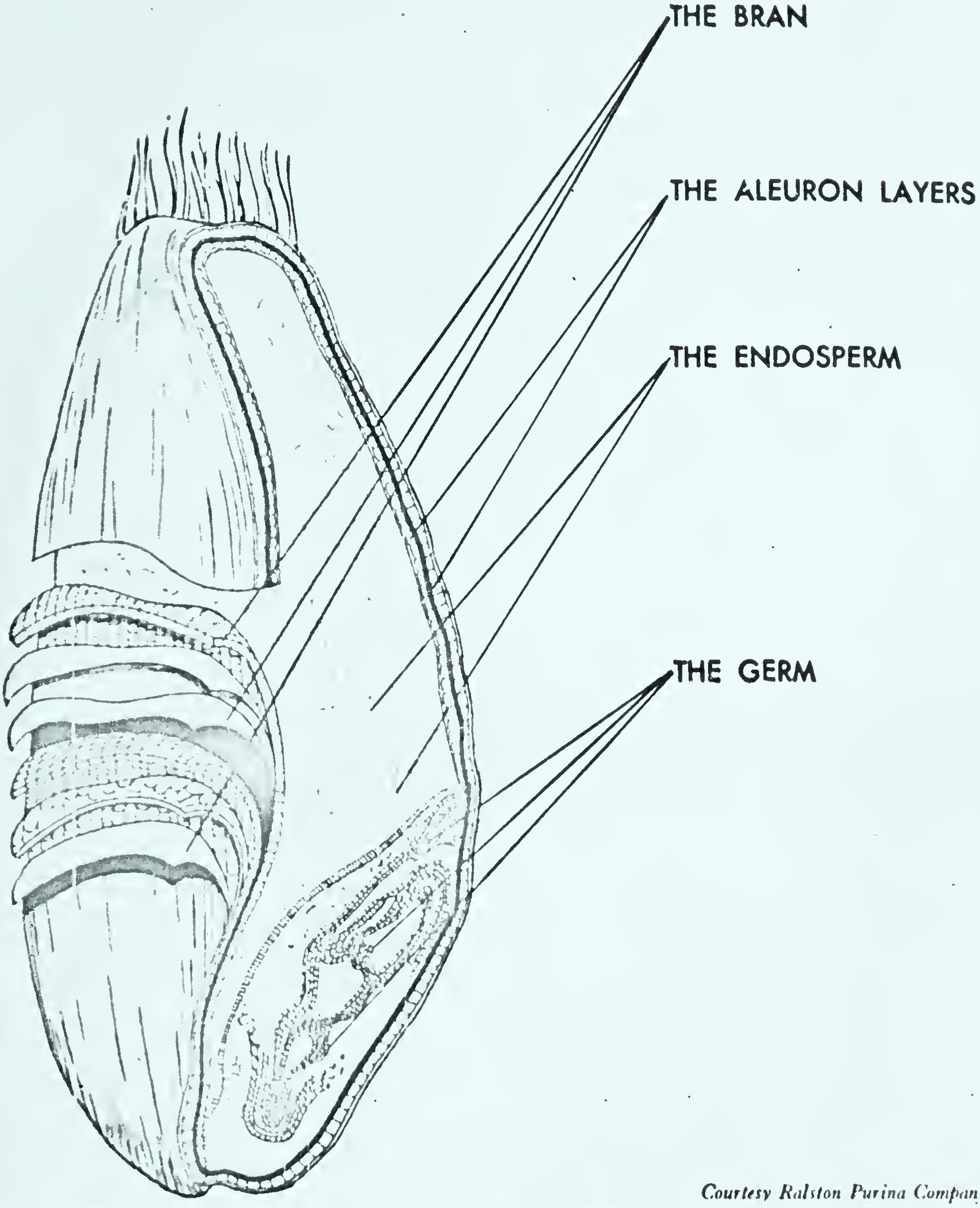
The grains most commonly used in this country are wheat, corn, rye, oats, rice, and barley. But wheat and its many products supply the largest amount of our grain foods. In other countries some other grain may be the main source of bread. For example, rye is used for black bread in parts of Europe and rice is used as a cereal in Asia.

Since whole-grain cereals are mostly carbohydrates, they are excellent sources of calories. They are also good sources of iron and phosphorus and fair sources of protein. The only vitamin contained in whole-grain cereals in appreciable amounts is thiamine. Riboflavin and niacin are present to a lesser extent. Such cereals also contain the natural proportions of bran, germ, and endosperm. Vitamin C is present in appreciable amounts in sprouted grains. Yellow corn products are good sources of vitamin A.

You will note that only the whole-grain and enriched flours, breads, and cereals qualify for inclusion in Group 6. This is because the refined and unenriched grain products contain considerably less iron, phosphorus, and B vitamins than the whole-grain and enriched products.

In the early 1940's, "enrichment" was developed as a partial remedy for the losses occurring in the refining of flour. Thiamine, niacin, and iron are added to white flour in amounts approximating those present in whole wheat, while the amount of ribo-

Cross Section of a Grain of Wheat



Courtesy Ralston Purina Company

THE BRAN consists of the brown outer layers of the grain of wheat. It contains bulk-forming carbohydrates, B vitamins, iron, and other minerals.

THE ALEURON LAYERS, which are right under the bran, are rich in protein and phosphorus.

THE ENDOSPERM is the white center of the grain. It is made up of carbohydrates and proteins and is used in highly refined white flours.

THE GERM, called the embryo, is the richest cereal source of thiamine. In addition, it contains other B vitamins, vitamin E, protein, fat, carbohydrates, iron and other minerals.

flavin exceeds considerably the amount in wheat. According to the American Institute of Baking, the cost of flour enrichment is about 1 cent for every 20 loaves of bread, which cost has been absorbed by the baker. The addition of skim milk further increases the nutritional value of bread, particularly in respect to calcium.

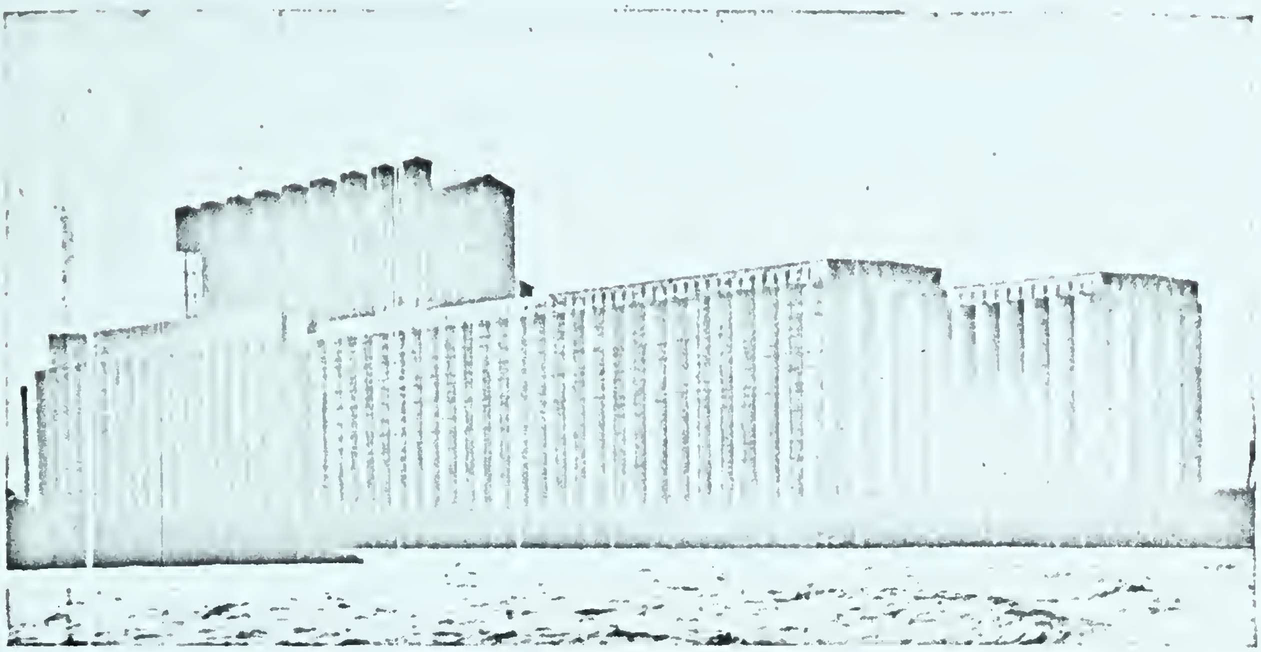
The term "restored" is applied to processed or refined breakfast cereals to which have been added certain of the B vitamins and iron to bring their levels up to the averages contained in whole grain.

Numerous commercially prepared cereals are available on the market under various trade names. Table 10 in Appendix A does not give the analysis of these foods separately. However, for meal-analysis purposes the averages listed in that table for the general classifications, such as "whole grain," "enriched or restored," and "unenriched," can be used by first referring to the statement on the cereal package to determine its classification and type of grain—whether wheat, oats, rice, or corn.

Ready-to-eat cereals are made of one or a combination of several grains. Other ingredients, such as sugar, sirup, malt, and salt, are added to the grains, and the mixture is precooked and processed. The various types of breakfast foods are marketed under different brand names by different manufacturers.

The food value of such cereals and breads when in the same classification is about the same for equal weights. For example, whole-wheat breakfast cereals, ounce for ounce, have similar food values. Also, the several types of whole-grain oats cereals or the various enriched wheat cereals are quite similar in food value. Manufacturers' claims for their cereals, consequently, cannot be on differences in nutritional value but rather on appeal to taste, appearance, and cost. In general, cost per serving of ready-to-eat cereals is about twice that of cereals to-be-cooked.

Since bread and cereals in most instances are now nutritionally better than they were a few years ago, the foods in Group 6 should properly have a larger place in our food planning. It is recommended that our daily bread supply, or equivalent in other grain products, be sufficient to allow two generous slices for each


Courtesy U.S. Dept. of Agriculture

Grain is stored in enormous grain elevators that are located in the rich grain belt of our country.

person for each meal. Breakfast cereals should be included at least occasionally, provided of course that they are enriched, restored, or whole-grain cereals. Study the package labels to learn what specific nutrients have been added to cereal breakfast foods. According to Dr. H. C. Sherman, enriched breadstuffs may be used safely to supply up to 40 percent of the calories of the normal diet, provided that sufficient amounts of other protective foods are also used in the diet. Such high amounts may be necessary in low-cost diets.

Group 7

In Group 7 are placed butter and margarine which has been fortified with vitamin A. At present fortified margarine is required to contain a minimum of 9,000 units of vitamin A per pound. This amount of vitamin A compares very favorably with the average amount contained in a pound of butter. Much of it has up to 15,000 units.

The foods in Group 7 also furnish fat, which you may recall contains 2¼ times as many calories per pound as carbohydrates or proteins. For those individuals who are on reducing diets, it is suggested that less butter and margarine be included in their

diets, provided that sufficient vitamin A is obtained from the foods in Groups 1 and 4.

It is recommended that some butter or fortified margarine be included daily in the diet. It is advisable that children have a large proportion of the family butter supply because they need the vitamin A for growth.

For cooking purposes, butter substitutes—such as margarine, lard, and vegetable fats—may be used to save on cost.

Foods That Are Not in the Basic Seven Food Groups

The foods not included in the Basic Seven Food Groups are largely the refined, concentrated, and unenriched foods which furnish a great many calories but small amounts of vitamins, minerals, or protein.

These foods are fats and oils, such as bacon, lard, salad dressings, and salt pork; milled cereals and products made from them, such as degerminated corn meal, cornstarch, macaroni, noodles, rice, spaghetti, and unenriched crackers, white bread, rolls, and white flour; sugars and other sweets, such as honey, jams, jellies, molasses, preserves, sirup, and sorghum; and cakes, candy, chocolate, cocoa, cookies, and pastries.

If a person knows a great deal about nutrition, it is possible to use these foods—many of which are relatively inexpensive—and yet have a balanced diet. But a person who knows that much about nutrition would be too eager to obtain maximum benefit from food and therefore would not wish to consume much of these less nutritious foods.

A little further explanation of the place of sugar and sweets in nutrition is desirable. Sweets ordinarily contain only sugar and therefore only calories. Candy is usually of this type. Some kinds also contain butter, eggs, fruits, milk, and nuts and therefore to some extent are more nutritious. Natural forms of sweets, such as honey, molasses, and brown sugar, have some other nutrients present in addition to sugar; but even these are relatively low in the essential nutrients.

Other common sources of sugar are the soft drinks. They

TABLE 7

Percentage of the Day's Requirements of Nutrients Supplied by One or Two Servings from Each of the Basic Seven Food Groups

Food group	Food item	Weight (gm)	Food energy (cal)	Protein (gm)
1	Broccoli, cooked, ½ C	100	37	3.3
2	Orange 1 medium	100	50	0.9
3	Potato, boiled, 1 small	100	85	2.0
3	Prunes, dried, 4 medium	33	99	0.8
4	Milk, whole, 1 qt	975	670	34.2
5	Beef, cooked, 3½ oz	100	235	18.2
6	Bread, whole-wheat, 5 slices	100	260	9.5
6	Whole-grain cereal, cooked, ⅔ C	30	111	3.1
7	Butter, 4 pats	28	204	Trace
	Total		1,751	72.0
	Percentage of Day's Needs			
Child: 7–9 years old			88	120
Girl: 13–15 years old			67	90
Boy: 16–20 years old			46	72
Women: Moderately active			88	120
Man: Physically active			58	103

Note: The balance of the day's needs, except for vitamin D, can readily be supplied by eating more of the foods listed in the table or by adding other foods. The child will probably not eat the size of portions given in the table, whereas the high school boy no doubt will eat considerably more.

Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
130	1.3	3,500	.06	.17	0.7	59
33	0.4	190	.08	.03	0.2	49
11	0.7	20	.08	.03	1.0	8
18	1.3	624	.03	.05	0.6	1
1,152	0.6	1,550	.34	1.68	1.1	13
11	2.7	0	.06	.13	4.4	0
60	2.5	0	.30	.15	3.5	0
11	1.1	0	.06	.04	1.3	0
4	.04	924	Trace	Trace	Trace	0
1,426	10.64	6,808	1.01	2.28	12.8	130
		Percentage of Day's Needs				
143	106	195	101	152	128	217
110	71	136	78	114	98	163
102	71	114	59	91	75	130
143	89	136	101	152	128	186
143	89	136	67	127	85	173

Courtesy Bureau of Human Nutrition and Home Economics

All seven of the Basic Seven Food Groups are represented in this picture. Try to identify 20 foods and name the group in which each one belongs.

ordinarily contain no other nutrients. Note how much such beverages can contribute toward unbalancing one's diet by considering the following not uncommon illustration. A young man who needs 3,000 calories per day consumes, in addition to his regular meals, five to six bottles of a soft drink which averages nearly 100 calories of sugar per bottle. This means that about 500 calories are supplied by the soft drinks, which amount represents one-sixth of the total calories. No doubt this person also obtains additional calories from other sources of refined foods which further aid in unbalancing the diet. Since soft drinks in most instances furnish energy only, they are nutrionally expensive and have no place in a low-cost but well-balanced diet.

Sugar is an inexpensive source of energy if we are taking into consideration only the energy needs. The vitamins and minerals will have to be obtained from more expensive sources to make up for the deficiencies in sugar, and consequently sugar may not actually be such a cheap food as it may first appear to be.

Nutritional Values of Beverages

Coffee and tea provide no nutritional value except as some other food, such as cream, milk, or sugar, is added. All beverages contribute water which can be counted toward the day's total needs.

These two beverages contain stimulants which are undesirable, especially for children. Also, these beverages tend to replace the much-needed milk and therefore, for growing children, can seriously interfere with the diet. Consequently, a young person should avoid the use of coffee and tea until he is physically mature. (See pages 222 and 223 for additional comments on coffee and tea.)

Hot cocoa and chocolate drinks contain fat and starch and therefore contribute calories. When made of milk, rather than water, the beverages have a considerably higher value. When not made with milk, such drinks should be avoided by young people unless the day's milk requirements have already been met.

Table 10 shows the relative food values of the more common food beverages. Note the large amounts of the various nutrients contained in fruit juices, milk, and beverages containing milk. The kola beverages are shown as containing sugar only.

Water is needed in the body for a variety of purposes, as discussed in Chapter 13. It is recommended that under normal conditions the average person drink six to eight glasses of water daily as a minimum. The actual amount needed is related to the number of foods with a high water content that are included in the diet. Drink water upon arising and between meals, as well as with meals. However, if water at mealtime reduces the appetite, it is better to drink it either at the end of the meal or between meals.

Since water contains no calories, it can have no fattening effect on the body. Water may contain minerals which are of value to the body, such as iodine and others which serve as laxatives.

Condiments and Spices

Condiments and spices contribute no important nutrients. They add to the taste of the food and therefore help to increase

the appetite. Used in moderation they have a place in food preparation, but used in excess they may be undesirable from a health viewpoint.

Table salt, sodium chloride, is needed by the body in moderation. Natural foods prepared correctly will supply much of our body needs for salt. The salting of foods adds to their flavor but should be done in moderation. The role of salt in connection with excessive perspiration is discussed in Chapter 13.

Checking on Meals for the Basic Seven Food Groups

By studying the following meal analysis[2] you will see how relatively easy it is to determine whether a day's menu is adequate or not.

A high school boy, "Pep" Watson, really wanted to find out whether he was getting an adequate diet. As a check on this, he listed all the food he had eaten the previous day.

Breakfast	*Dinner*	*Supper*
Sliced orange	Pork chop	Egg omelet
Cooked whole-grain cereal with raisins	Baked potato	Buttered beets
Toast and butter	String beans	Bread and butter
Milk	Mixed vegetable salad	Baked apple
	Whole-wheat biscuits	Milk
	Rice pudding	
	Milk	

In examining the day's menu, Pep found that he had supplied himself with the following foods from the Basic Seven Food Groups:

Group 1: 1 serving string beans and lettuce in the salad
Group 2: 1 serving of orange
Group 3: 1 serving baked potatoes, beets, a baked apple, and raisins
Group 4: 3 glasses of milk—some on cereal and some in pudding
Group 5: 1 serving of meat (pork chop) and at least one egg

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[2] Adapted from *The Food We Live By*, Nutrition Division, Federal Security Agency, Washington, D.C., 1942.

Group 6: Whole-grain cereal and bread—cooked cereal, biscuits, and rice
Group 7: 2 tablespoons of butter

He found that his meals had supplied some foods from each of the basic food groups and had met the requirements of good nutrition.

When "Pudgy" Baxter, Pep's friend, made a similar examination of his diet, he found that the results were far from satisfactory. Here is what he ate for his three meals, including between-meal snacks, on the previous day:

Breakfast	*Lunch*	*Dinner*
Corn flakes, milk	A kola beverage	Bologna
Coffee	Candy bar	Fried potatoes
	Hamburger	Biscuits and butter
		Pumpkin pie
		Coffee

He also had a candy bar between lunch and dinner.

In terms of the Basic Seven Food Groups, his meals supplied him with the following:

Group 1: None
Group 2: None
Group 3: One serving of potatoes and one of pumpkin
Group 4: Only the milk used in the pumpkin pie and with the corn flakes
Group 5: Some egg, but not enough (only in pie). Two servings of meat—hamburger and bologna
Group 6: Cereals and bread (dry cereal for breakfast, bun in the hamburger, biscuits), but none of it whole grain
Group 7: Butter on his biscuits

Pudgy's diet was short on vitamins and minerals and too strong on sweets, breads, and cereals.

Planning for good nutrition can be fun and can pay big dividends. Perhaps you, like Pep, could check your diet at this time.

For Review

1. What nutrients do each of the Basic Seven Food Groups principally supply?
2. What other foods besides citrus fruits are included in Group 2? Why?
3. How do cheese and evaporated milk compare in food value with whole milk?
4. How do the food values of meat, poultry, and fish compare?
5. Discuss the food value of soybeans.
6. Name some meat alternates.
7. Discuss "enrichment" as applied to bread and flour.
8. Name several foods not included in the Basic Seven Food Groups. What is their principal food value?
9. Discuss the nutritional value of soft drinks.
10. What are the comparative food values of coffee, tea, cocoa, and chocolate?

For Personal Application

1. Examine the meals listed on page 382, or from any other source, and classify the various foods according to the Basic Seven Food Groups. Use the procedures described on pages 166 and 167 and on page 359. Indicate which groups are adequately supplied, inadequately supplied, or missing.
2. Examine Table 7, Percentage of the Day's Requirements of Nutrients Supplied by One or Two Servings from Each of the Basic Seven Food Groups. How do the totals compare with your own needs? What additions to this list would you need to make to meet any deficiencies?
3. Assemble various labels from cereal packages and bread wrappers and compare the various claims.
4. What size egg (pullet, medium, or large) is the best buy in proportion to cost and actual weight (ounces) per dozen? Use the prevailing prices in your community.
5. Compare the costs of cereals cooked at home with ready-to-serve cereals. Use Table 10 in Appendix A to determine dry weight of servings, if you do not weigh them yourself.
6. On the basis of the information given in the Master Food Plan at Low Cost on page 378 of Appendix D, estimate the amount of food needed for your family for a week.

7. Do the same as in item 6, using as your guide the Master Food Plan at Moderate Cost on page 380.
8. Keep an accurate record of a week's (or month's) supply of all foods purchased in your home. Compare these figures (totals) with those which you obtain in items 6 or 7. The price level of your family market list will determine which comparison to make. In which food groups are you high, average, or low?

11

MEALS SHOULD BE PLANNED

> Dietary deficiency diseases in severe form—scurvy, rickets, and pellagra—are not so common among children as a decade or two ago. But they still exist, particularly among children of low-income families. Many more children suffer from general malnutrition, which causes them to grow at less than the normal rate and have less than average resistance to infections.
>
> THE NATIONAL HEALTH ASSEMBLY[1]

Satisfactory meals are planned meals. To be satisfactory, a meal should (1) have a high nutritional value; (2) come within the food budget; (3) be prepared correctly; (4) be appealing to the appetite; (5) be served attractively.

These requirements can hardly be fulfilled without careful planning. While meal planning at home is generally done by the mother, each individual has many selections of his own to make when eating out, and the selection of food for these meals also entails some planning.

[1] From *The Nation's Health, A Ten Year Program.* A Report to the President by Oscar R. Ewing, Federal Security Administrator, of the National Health Assembly of 1948.

In this chapter we shall show you how to plan a full day's diet of three meals and how to check your own meals to determine whether you are getting the right foods in the correct amounts. The matter of purchasing foods is not considered, except by reference to the family food plans listed in Appendix D.

In planning the day's meals, whether at home or in a cafeteria or restaurant, it is important that each meal contribute its share to the total food requirements for that day. If one or two of the day's meals are unbalanced, it is more difficult to plan the other meal or meals to make up for the deficiencies. Therefore, each meal should, in most instances, be well balanced, or "complete." When a given meal is low or high in some nutrient, the other meals need to be planned with this fact in mind. When there are deficiencies in the first two meals of the day, dinner is more difficult to plan.

Because there is such a wide choice of foods within the various groups of the Basic Seven, it is possible to make plans that fulfill requirements and that, at the same time, take into account food preferences, the availability of foods, the cost, and other factors. The exceptions to the matter of choice, though, are milk and citrus fruits or tomatoes—all of which are so essential and all of which lack satisfactory substitutes—which must be included in the diet daily.

Food Preferences and Meal Planning

All of us have some foods which we like particularly well or some kinds of foods which we prefer over others; but we should avoid letting our food preferences rule our diets. Don't be a food fusser. You probably dislike some foods or dishes because your father or mother did—or maybe because your grandparents did. But there is a difference between food preferences and food idiosyncrasies.

Planning meals properly is difficult enough without having to take into consideration a lot of food idiosyncrasies. Limited food habits can be a social disadvantage because you are expected to eat what is served to you when you are a guest. Perhaps you

have built up a dislike for certain foods without even having tried them. Keep trying to eat all kinds of food. If you dislike them in one form, try them prepared in another way. Be an explorer of foods. Try new foods occasionally and try old foods prepared in a new way.

When babies are not trained properly so far as food habits are concerned, they are potential adult food fussers. New foods should be introduced to babies gradually so that they can become accustomed to new flavors and textures. Children should be taught to enjoy foods and should be helped along in learning to eat new ones or old ones with new recipes. By the age of seven, every child should have learned to like a variety of foods and be willing to try new ones. By the time he is in his teens, he should have learned to eat all kinds of foods.

Of course, if a person is really allergic to a specific food, that is a different matter. But allergy to certain foods should not be used as an excuse for not eating such foods unless it is certain that allergy is the real cause for the dislike. Happy is the home without a food fusser. (Review pages 49 to 51 for more information on food habits, traditions, and preferences.)

The Daily Meal Pattern

The following daily meal pattern can serve as a guide for the individual or for the whole family in planning the meals by the day and by the week:

Breakfast	*Lunch or Supper*	*Dinner* (evening or noon)
Fruit	Sandwich or main dish with fruit and vegetables	Meat, fish, or poultry
Cereal with milk	Bread and butter	Potato
Egg	Dessert (optional—preferably fruit)	Cooked vegetable
Bread and butter	Milk or other milk beverage	Green or raw vegetable salad or fruit
Milk (coffee for adults)		Dessert
		Bread and butter
		Beverage

Variations in the size of the servings may be all that is necessary for the various members of the family to meet their differing

needs adequately with the same menu. Such variations would apply mainly to the number of calories needed, and, in the case of children, to the amount of milk required. The pattern permits considerable variation in different kinds of food from day to day.

It is important that the three meals contribute approximately the following percentages of the day's total requirements for each of the various nutrients: breakfast—at least 25 percent; lunch or supper—at least 33 percent; dinner—the balance, or about 40 percent.

In addition to the foods included in the menus discussed in this chapter, it is essential for children and young people, and advisable for adults, to have cod-liver oil or some other good source of vitamin D included in their diet from approximately September to May, when one is less exposed to sunlight. As mentioned in Chapter 9, vitamin D is not obtained in adequate quantity in an average diet.

Breakfast—The Forgotten Meal

Americans used to eat heartier and better balanced breakfasts than they do today. More people were employed on the farm or in other physical work than is the case today, and so they required more food. Also, more people worked at home and did not have to rush off to work elsewhere in the morning. So they were more likely to take time to eat their morning meal. Today many girls and women foolishly cut down on breakfast in order to keep themselves slender, whereas their great-grandmothers probably were less concerned about weight. Many other reasons contribute to the change in breakfast habits of the American people, but the present habit of eating nothing or very little for breakfast—and eating that hurriedly—is one of our country's most harmful food habits.

A recent nation-wide survey showed that Americans begin at an early age to skip breakfast and that it soon becomes the neglected meal of the day. Fifty-nine percent of those between sixteen and nineteen years of age said that, of the day's three meals, they would be most willing to omit breakfast. The princi-

Courtesy General Mills, Inc.

A breakfast cereal with fruit on top provides three basic foods in one dish—cereal, milk, and fruit.

pal reason given by these young people was "I'm not hungry then." No breakfast at all is more prevalent among the young than the old, and women are more likely than men to skip breakfast or to eat an inadequate meal. In another survey of 50,000 students, it was found that only 34 percent ate what might be considered a satisfactory breakfast.

Women are frequently heard to say that they do not eat breakfast because they are dieting. But that is insufficient reason for eliminating all nutrients. This argument is too often an alibi for late sleeping. In the average American home the various members of the family remain in bed until the last moment, and then gulp down an inadequate breakfast. If they would arise 10 minutes earlier, eat a sensible breakfast, and avoid the pressure of not having enough time, they would feel better, look better, do better work, and maintain smoother dispositions.

Eating or not eating breakfast is only a habit. If you become

accustomed to a good breakfast, you feel that you can't do without it. If you start to omit it, you may in time not miss it.

The importance of a good breakfast. In many ways breakfast is the most important meal of the day, because the body has been without food for 10 to 15 hours. Breakfast breaks your longest fast. If the first meal of the day is lunch, then you have gone a period of about 18 hours without food. Breakfast should give you a "break," not a "brake."

Inadequate breakfasts may contribute to fatigue and lessened efficiency for the industrial worker, the student, the homemaker, or the business person. "You can't breakfast like a bird and work like a horse" is a good slogan which has been used with industrial workers. The same statement, of course, should apply to all of us.

A study of accidents made in an industrial plant showed that the greatest number of accidents occurred between 11:00 A.M. and noon. Health authorities believe that one of the principal reasons for the high accident rate at that time of the day is inadequate breakfasts.

Furthermore, no breakfast at all, or a breakfast consisting of a cup of coffee and a doughnut, makes it difficult to meet all the nutrition requirements for the day in the remaining meals.

Since many individuals find it difficult to obtain an adequate lunch, it is that much more desirable that their breakfasts be sufficient in quantity and quality.

What constitutes a good breakfast? Nutritional and medical authorities recommend that the breakfast provide from one-fourth to one-third of the day's total food requirements. A simple basic breakfast pattern for children, youths, and adults includes fruit, milk, cereal, an egg, bread, and butter.

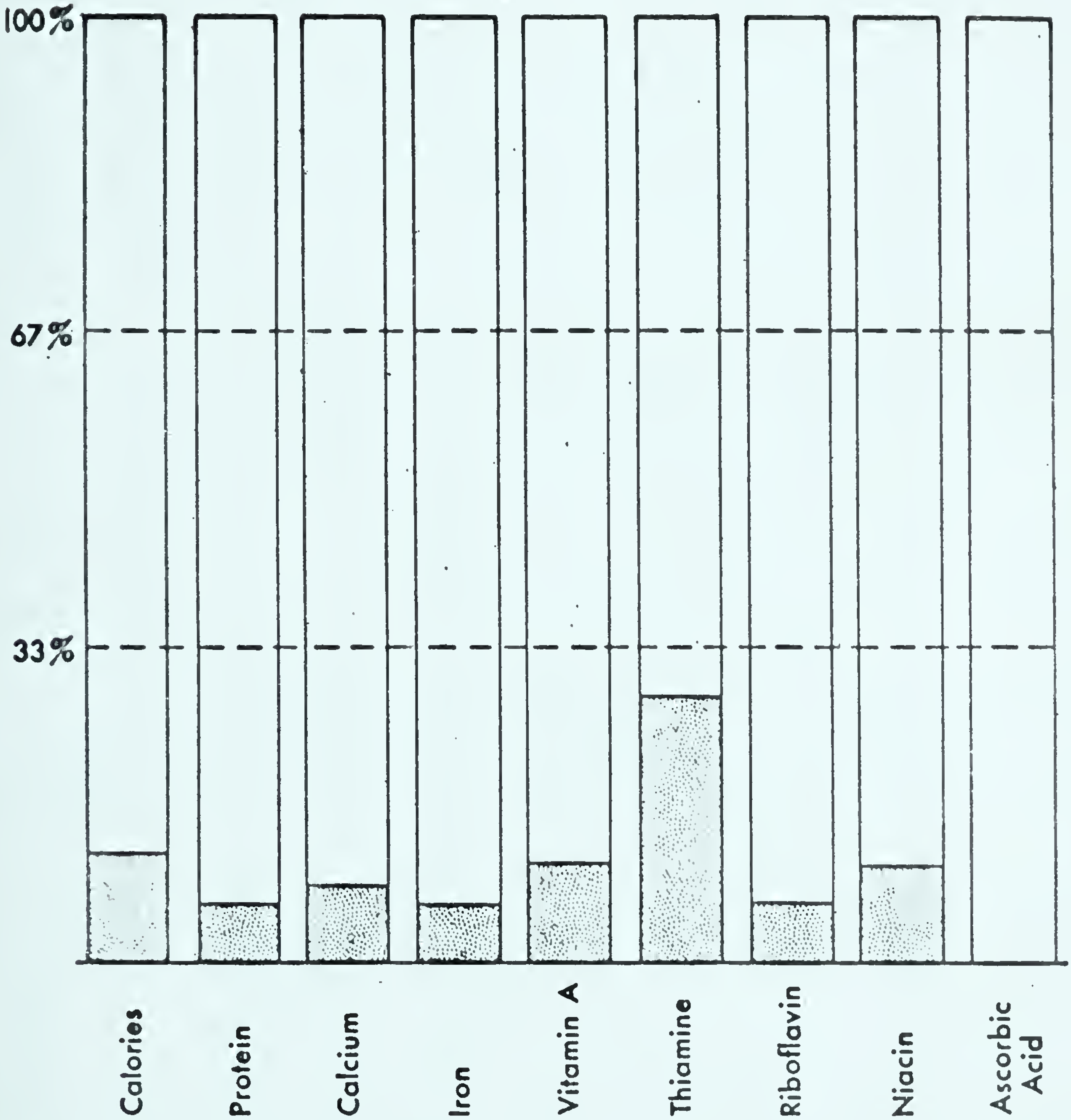
A complete breakfast for children consists of fruit or fruit juice; cereal and whole milk and/or egg, bacon or creamed meat; whole-wheat or enriched bread or toast; butter or fortified margarine; and milk. The same menu also applies to adults, with the difference that coffee might be substituted for milk as a beverage if so preferred, provided that they get their minimum of

A Poor Breakfast

MENU

Sweet Roll

Coffee



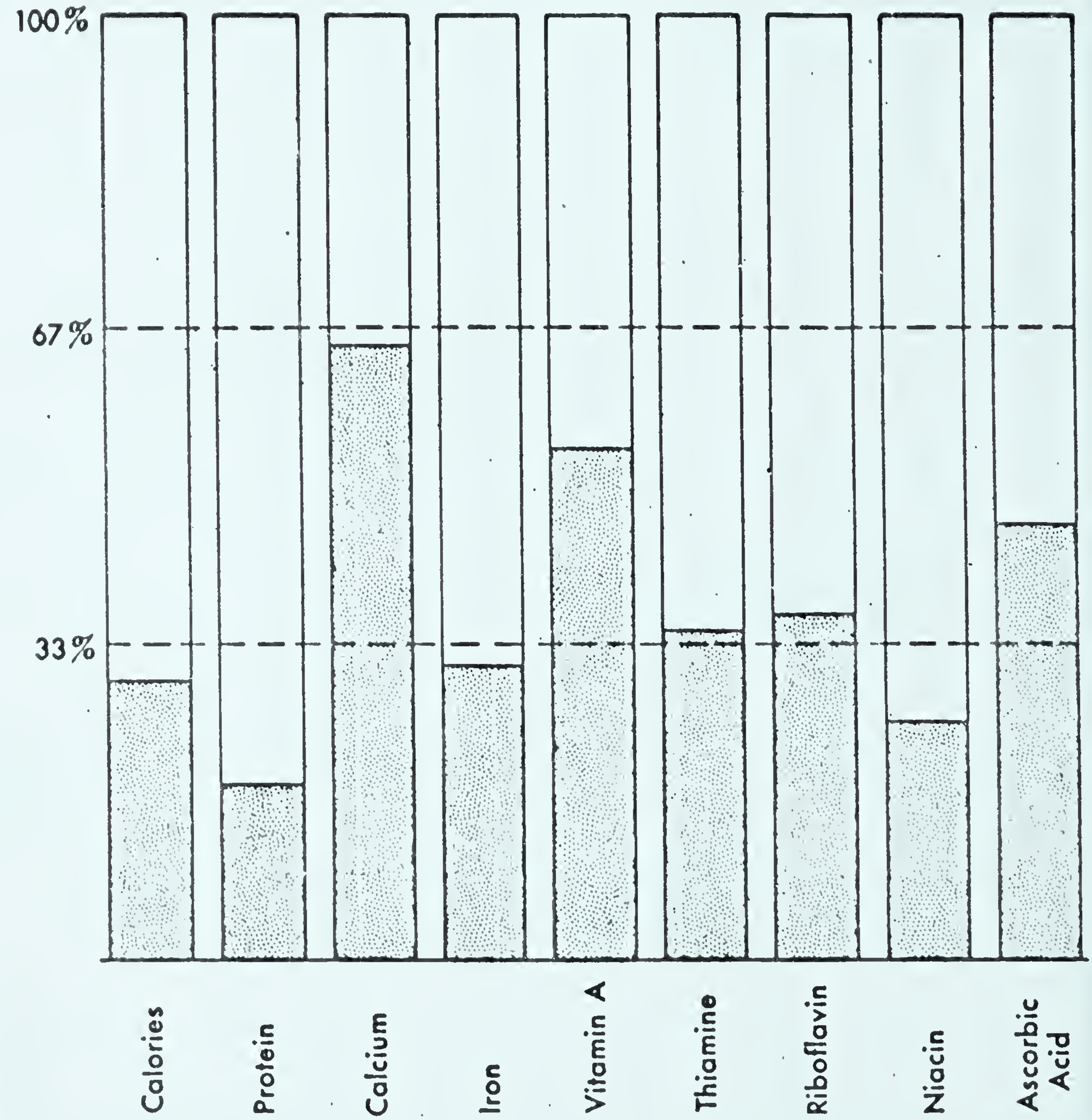
Adapted by courtesy National Dairy Council

People who start the day off with a sweet roll and coffee only are gambling with their health, since they seldom make up for the lost nutrients in other meals.

A Good Breakfast

MENU

Tomato Juice
Cooked Whole-grain Cereal
Toast and Butter
Milk



Adapted by courtesy National Dairy Council

A breakfast of citrus fruit or tomato juice, cereal, and milk supplies a good part of the day's needs. An egg would help to raise the protein amount.

two glasses of milk during the day. Additional nutrients and calories, which may be needed to meet some individuals' requirements, can readily be supplied by the addition of large portions of the "basic pattern" foods (see page 172).

The breakfast might be planned to include foods which are less likely to be eaten in other meals.

The breakfasts given on pages 176 and 177 show the comparative values of a well-balanced breakfast and one that is not so well balanced, yet typical of what many eat — if they eat breakfast at all.

Lunch—Not Just a Snack

Consider lunch as an important meal and not just as a snack intended to stave off hunger until you sit down to a big meal in the evening.

Much progress has been made toward the improvement of the lunches eaten among certain groups. School children have obviously benefited by the school-lunch program sponsored by the schools—frequently with government financial aid. In industries, considerable improvement has been made in the quality of meals available to workers through industrial cafeterias. Also there has been a gratifying improvement in the lunch selections made by the employees themselves.

However, too many individuals still continue to eat too little at noon or to eat unbalanced lunches. For growing children and young people this is obviously a serious matter. Too often the lunch consists of hot dogs, a soda, and candy—a very inadequate lunch.

The importance of a good lunch. Lunch should supply at least one-third of the day's food needs in the various nutrients. Those who desire a noon meal which is not too heavy—that is, one with not too many calories—should plan at least to meet the requirements in respect to the other needs, with special emphasis upon vitamins and minerals. These standards should be maintained regardless of whether you eat your lunch at home, carry a lunch box, or eat in a public restaurant or school cafeteria. It is very

Which Kind of Lunch Do You Eat?

Courtesy Chicago Public Schools

—one consisting of a frankfurter and a bottle of pop, which is lacking in the vitamins and minerals that you need for growth and development . . .

Courtesy U.S. Dept. of Agriculture

. . . or a lunch consisting of a protein dish, a vegetable and/or a fruit, whole-wheat bread and butter, and milk, which will help you to keep well and to have vitality?

important that everyone eat satisfactorily at noon—whether it be young children, students, stenographers, industrial workers, businessmen, or homemakers.

Many individuals, young women in particular, skimp on lunch to save money or to keep their weight down. As discussed later (Chapter 14), the correct way to keep one's weight down, and at the same time maintain good health, is to reduce the number of calories in all the meals but not to omit lunches. People who wish to reduce should take greater pains to balance their meals accordingly rather than to go without them.

What constitutes a good lunch? Lunch should include a meat, a meat-flavored dish, or some other protein dish; a vegetable, preferably raw; dessert or fruit; bread and butter or fortified margarine; and milk or a milk drink. Many of the supper suggestions on page 185 also apply to lunch.

If it is a packed lunch, the meal suggestions will have to be varied somewhat with respect to the main dish, which probably would be a sandwich. A cold plate lunch can be as adequate nutritionally as a hot plate lunch.

The packed lunch. Many individuals—school children, industrial workers, office personnel, and others—find it necessary or desirable to carry a packed lunch. Such a meal calls for careful planning.

A carried lunch should be considered as much a part of the day's meals as breakfast or dinner. It should supply its share—that is, about one-third of the day's food needs. So the rules of good nutrition should be applied to the lunch box as well as to other meals, even if it means a little more effort and time.

The traditional lunch box, consisting of bologna or cheese sandwiches, pie or cake, and a bottle of coffee, is outmoded today and should be replaced by a more balanced menu.

The packed lunch should have variety and appetite appeal. It should contain foods which have good keeping qualities, and it should include each day some foods from each of these types:

Milk—in food or drink

Bread, whole-wheat or enriched—in sandwiches, puddings, or meat loaves

- Meat, fish, eggs, or cheese—in sandwich fillings, salads, or hearty main dishes
- Fruit, at least one—plain or in salads or puddings
- Vegetables, at least one—in sandwich fillings, salads, or in hearty main dishes

Wholesome, hearty sandwiches can be made with the following fillings:

Deviled eggs	Salmon	Peanut butter
Tongue	Cheese	Sardines
Dried beef	Cream cheese and nuts	Vegetables

Raw vegetables add food value and crispness to any lunch. Good, raw vegetables which may be included in the lunch box are carrots, cabbage, tomatoes, onions, cucumbers, cress, chives, lettuce, radishes, and cauliflower. Raw vegetables may be wrapped in waxed paper in order to retain their crispness.

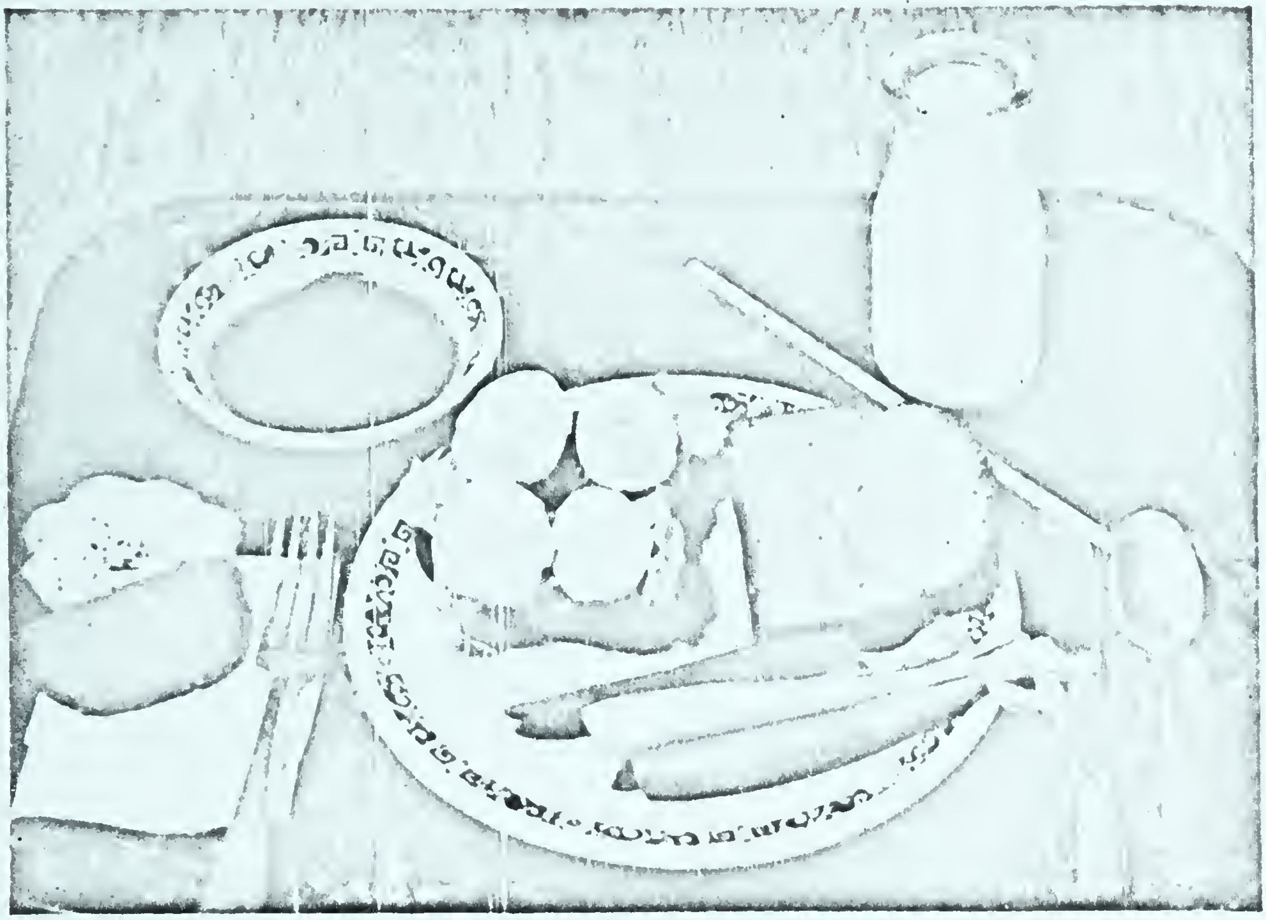
It is easier to prepare a satisfactory box lunch if it includes a thermos bottle with either a hot or a cold beverage. Here are a few suggestions for hot and cold luncheon beverages:

Milk or buttermilk	Canned tomatoes (strained and seasoned)
Coffee	Lemonade
Tea	Orange juice
Hot soups	Vegetable and fruit juices
Tomato juice	

Milk belongs in the lunch box if the person is unable to obtain it at school or at his place of work.

Desserts make a box lunch interesting. Here are some suggestions which contribute value to the meal:

- Fresh fruit, in season, or dried fruits, washed and wrapped in waxed paper
- Cheese
- Cookies made with whole-grain cereals, enriched flour, fruits, and nuts
- Cakes made with enriched flour, eggs, and milk
- Pies with crust made from enriched flour, and fillings made from fruits, such as apricots, apples, raisins, prunes, rhubarb, and cherries



Courtesy U.S. Dept. of Agriculture

A school lunch does not have to consist of hot foods in order to be nourishing. This lunch of cold foods is a Type-A school lunch.

The school lunch. The principles for selecting an adequate school lunch are the same as those already mentioned under the subject of lunches. For those pupils who attend school where complete meals are supplied in the cafeteria, it is important that the right kinds of foods are available and that wise selections are made from these desirable foods.

For those pupils who bring a packed lunch from home, supplementary foods may be available from the school lunchroom or the cafeteria. These foods should be selected so as to contribute toward a balanced meal. Perhaps a glass of milk, a bowl of soup, or a fruit dessert from the school lunchroom will help to make the home-packed lunch complete and more tasty.

The school cafeteria is the place where those who are going to school have an opportunity to exercise a choice and thereby demonstrate their knowledge of good nutrition and their willingness to apply such knowledge. *Meal selection should be considered an educational experience.*

That the school lunch is important and that the best foods should be available is shown by the fact that the United States Congress enacted the National School Lunch Act in 1946 to assure good school lunches for American students. Schools receive reimbursement from the government according to certain standards.

As an incentive for providing a wholesome lunch, the highest rate of reimbursement to schools is given for the complete lunch. This is known as a Type-A lunch and consists of the following foods:

1. One-half pint of whole milk as a beverage
2. Two ounces of lean meat, poultry, fish, or cheese, or one egg, or one-half cup of dry beans or peas, or four tablespoons of peanut butter
3. Three-fourths cup of vegetables or fruit or both
4. One or more portions of bread or muffins or other bread made of whole-grain cereal or enriched flour
5. Two teaspoons of butter or fortified margarine

It is permissible to meet the protein requirement of item 2 by serving one-half the quantities of each of two of the protein-rich foods.

If a school has limited lunchroom facilities, it may contract to serve a Type-B lunch, which provides about two-thirds as much food as the Type-A lunch. The Type-B lunch should be supplemented by food brought from home.

Schools that have no lunchroom facilities may wish to provide a Type-C lunch, which consists of a ½ pint of whole milk as a beverage.

A school lunch which meets the requirements for Type A is analyzed in Table 16 on page 362. Also shown is the percentage of the day's need for each nutrient for several different ages of school children. Study this table carefully.

Various foods are constantly tried out in the experimental kitchen of the Bureau of Human Nutrition and Home Economics of the U.S. Department of Agriculture to learn what recipes are acceptable to the elementary and high school students. The

Bureau is also seeking to learn how well school lunches actually served are meeting children's nutritional needs. Sample lunches from cooperating schools are analyzed in the laboratory to determine their content of important nutrients.

Dinner—The Largest Meal

Because dinner in most American families is generally the largest meal of the day and includes more varieties of food, it is more likely to lend itself to nutritional balancing. However, the number of items in this meal should not be the main consideration.

The importance of a good dinner. The important point about dinner is that it be nutritionally well balanced and, where necessary, that it help to make up for any deficiencies that may be present in the other meals of the day. The better balanced the other two meals have been, the easier it will be to plan the dinner, and the simpler it can be made. Dinner can usually be eaten more leisurely than any other meal, especially if it is the evening meal, and so can contribute much to the individual's and the family's enjoyment.

What constitutes a good dinner? Dinners for many people need not differ in menu plan from the suggestions given for lunches and suppers, except in size of portions.

A dinner, whether served at night or at noon, should include the following foods:

Meat, fish, or poultry—one of these
Potato—either white or sweet
Vegetables—leafy or yellow or green
Salad—fresh greens or fruits
Dessert—such as pudding or fruit
Bread and butter or fortified margarine
Milk for children and coffee or tea for adults

Specific suggestions for dinners and for other meals are given on pages 382 and 383 of Appendix D. In addition, several meals are analyzed in the tables in Appendix B. Note the percentages of the daily food needs met by each of these individual meals.

Supper—A Light Dinner

Supper here is used as the term for the evening meal when the noon meal has been more substantial and may have been dignified with the name "dinner."

Meal suggestions already given for lunch apply, in the main, to supper as well. However, some other suggestions may be given for this light meal in the evening.

Supper should be simple but nutritious. For young children it should include foods from the following groups:

Whole-grain cereal and whole milk
Baked or mashed potatoes and/or other vegetables
Cooked fruit or raw salad
Milk to drink

For older children, supper might include foods from these groups:

Thick nutritious soup or stew, or other type of one-dish meal
Raw or cooked vegetables
Whole-wheat or enriched bread, butter or fortified margarine
Fruit or simple dessert
Milk to drink

Any of these additional suggestions are also good as the main dish at suppertime:

Beef and noodles
Creamed meat or chicken with biscuit
Soups, made with meat stock and thick with vegetables
Casserole dishes
Assorted cooked vegetables
Macaroni or other cereal with cheese
Eggs
Baked beans

Extra Meals

In the lives of most people, there are many occasions for eating in addition to the three meals of the day. Many people like

between-meal or before-bedtime snacks. Social events generally include refreshments of a sort. There is nothing wrong with these extra meals, but it should be remembered that they contribute to or detract from the nutritional requirement of the day, just as food eaten at regular meals does. Thus, in planning the day's diet, they too must be taken into consideration.

Between-meal snacks. Most children and many young people and adults eat snacks in the midmorning, midafternoon, or before retiring. Therefore, we shall discuss the relative merits of such between-meal eating and suggest what foods might preferably be included in such snacks.

The value of between-meal snacks. For people who do not obtain sufficient food in their three meals of the day, between-meal snacks contribute to their general needs. One study has demonstrated an additional advantage, namely, that individuals are more efficient if they do not go over 4½ hours without food. This does not mean that individuals who are already getting sufficient food in their regular meals should add these "snacks" to their regular intake of food. Rather, it means that it is preferable, if at all possible, for individuals to divide their total food requirements among four or five meals instead of among the conventional three meals.

Considerable attention has been given to between-meal feeding by industry in recent years as a means of stepping up production through improved health, efficiency, and morale of the workers. Some of the findings and practices of industry should be applicable also to office workers, students, and homemakers.

In a study of the productivity of employees in a shoe factory in New England, it was found that definite improvement in the output of certain types of piecework occurred when midmorning and midafternoon snacks of milk and cake were eaten. In some instances the sustained increase in production was as much as 10 percent. An industrial plant in the South has reported a 10 to 13 percent boost in production by giving employees a bottle of milk in midmorning and midafternoon. A plant in New Jersey stated that there was a definite decrease in the accident rate when milk was supplied to all the employees between meals. No doubt

Courtesy National Dairy Products Corp.

A cold glass of milk with some tasty cookies make a good snack for after school that is both easy to prepare and nutritious.

some psychological and physiological factors, as well as nutritional factors, contribute to improved morale and efficiency by these breaks in the day's routine for rest and food.

Young children, undernourished children and adults, and those individuals who have either an incomplete or very early breakfast should eat some food as a midmorning snack. Such a meal might consist of fruit or fruit juice, tomato juice, milk, and whole-wheat or graham wafers. Cod-liver oil should also be added for the two- to five-year-olds.

A midafternoon snack is also desirable for young children, undernourished children and adults, and those who will have either an incomplete or very late supper. The midafternoon lunch can include fruit, fruit juices, milk, bread and butter, or some type of wholesome sandwich.

Standards for snacks. The foods selected at such times should meet the standards of good nutrition and should supplement the other three meals of the day. The between-meal snacks which consist of coffee or a soft drink and pie or pastry contribute little but calories and should be replaced by more nutritious items. An orange, a glass of milk, or an apple can give you just as much and more of a "lift" and is much better for you than a kola drink. (See page 330 of Table 10 for the food value of kola drinks.) Soft drinks supply only calories—no vitamins or minerals.

For children and adults who are underweight, foods contributing calories as well as other nutrients are recommended. For those individuals who are not in need of extra calories, it is well that the foods selected be those which are relatively high in vitamins, minerals, and possibly protein, depending upon what is contained in the other meals.

For children, it is important that these between-meal lunches do not come so close to mealtimes that their appetites are spoiled for the regular meals.

Snacks before bedtime. Food eaten shortly before retiring may or may not be beneficial. A light lunch at such time may be desirable or permissible for those individuals who really need additional food—provided that it does not interfere with their sleep.

Many people, of course, find that eating before retiring is

conducive to sleep. It is probably just as often a matter of psychology as anything else. Many of those who complain that eating in the evening affects their sleep are possibly stimulated by the excitement connected with the occasions at which food is served. Coffee may contribute to insomnia in the case of adults.

If food is eaten in the evening, it preferably should be easily digested food, such as milk, fruit, and bread. High-calorie foods will of course add pounds whether eaten as part of a regular meal or at other times. So you may have to be guided by your personal weight. To eat, or not to eat, before going to bed is essentially a matter of individual decision.

Refreshments for parties. Many of the suggestions for meals and snacks already discussed also apply to refreshments. However, since refreshments usually imply a party, or that some friends are eating with you, a few special hints are here presented.

Light refreshments should be served at an afternoon tea or party. Too much food at that time of the day may spoil the appetite for the evening meal. The main purpose of serving refreshments at such times is to contribute to the afternoon's entertainment, rather than to meet the food needs of the guests. Light sandwiches, small cakes, ice cream, and hot or cold drinks are suggestions for afternoon teas or parties.

Refreshments for evening parties should also be light. Fruit salads, crackers and cheese, cold cuts, ice cream, cookies, cake, nuts, and popcorn are usually enjoyed by all. An evening party may at times include a regular meal; if such is the case, a buffet supper adds to the evening's entertainment. Evening parties should be much fun, and the refreshments should contribute by being served easily and informally.

Drinks for afternoon or evening parties can be made both tasty and nutritious. Of course, coffee and tea are usually preferred by adults. Young people, however, like milk, hot chocolate, fruit juices, and soft drinks. Fruit juices are especially recommended for hot weather.

Some additional pointers concerning the planning of refreshments for parties follow:

1. Plan the menu for the party with your mother.

2. Plan to serve refreshments which can be prepared in advance. By so doing, you will be able to spend more time with your guests.

3. Food should be attractive in appearance as well as tasty. If the date of the party has been selected because of some special holiday or festivity, such as Washington's birthday or St. Valentine's Day, both the refreshments and the decorations can be planned around that theme.

4. Have a few of your best friends at the party help you with the serving.

5. If there are boys at the party, plan to serve more substantial foods. Also, young people usually like seconds.

6. Serve the food at a time that fits into the program of the party so as not to interrupt a game or other entertainment at a crucial point.

Outdoor cooking. Many individuals, families, and groups enjoy outdoor eating. If the affair is in the nature of a one-meal picnic or hike, or a one-day trip, most of the foods will have been prepared at home, with the possible exceptions of the meat and the beverage.

If the hikers or picnickers are more adventuresome, they may prefer to prepare their whole meal in the outdoors. Food plans need to be carefully made in advance for such occasions. If the meal is to be prepared over an open fire, try any of the following foods: bacon, wieners, hamburgers, sausage, steaks, chops, and even chicken if already cut up.

Roasted green corn and baked potatoes are very tasty foods prepared in the open. Griddle cakes or flapjacks are traditional camping foods. Both vegetables and fruits—fresh, canned, or dried—help to round out a camp meal, both nutritionally and from the point of view of taste.

For trips or camping periods lasting several days, more extensive guidance is needed than can here be given. For helpful suggestions on outdoor cooking, see the references on the subject listed in the Bibliography.

Meal Planning for Particular Groups

There are many groups of individuals for which special meal planning is necessary. Most of these groups are in need of a physician's advice in regard to their food requirements, and so a discussion of their diets is outside the scope of this book. However, brief general comments are here given concerning the meal planning for two groups of individuals—athletes and older people.

The athlete and his meals. Many people think that athletes should have specially planned meals. The athlete does need a well-balanced diet, just like anyone else. But beyond this, no particular diet is known that has some unusual virtue for the one who participates in sports. Because of his extra physical activity, the athlete needs more calories than others who are not so engaged. But he does not require so many calories as the individual who is engaged in physical work all day long. Thiamine and niacin need to be increased with an increase in calories from carbohydrates.

A *high*-meat diet is not required in the case of extra physical activity. What is needed is a *sufficient* amount of protein, and this protein can be supplied by meat, fish, milk, and other protein-rich foods. Read again Chapters 4, 5, and 6, which deal with energy and protein needs.

In past years a great deal of attention has been given to separate training tables for college athletes. The diets supplied usually represented the individual views of the coach or the trainer. The advantage of a separate training table for the athlete is mainly to make sure that he does get well-balanced meals which also are appetizing and easily digested. Other students who are not participating in sports are equally in need of well-balanced meals. However, the consequence of violating the training rules as applied to food are more likely to be apparent in the case of athletes.

What the athlete also needs to watch is his general hygiene, such as sleep and rest, and signs of nervousness and strain. Such factors may upset his digestive system, especially prior to and during a game. Heavy meals near game time should be avoided.

Meals for older people. How you will feel when you are older will in part be dependent upon how you eat now. Therefore, it is important to understand certain points about the diet of mature and aged individuals. Some of this information will no doubt also apply to older members of your own family.

A man of sixty may be as young, vigorous, and vital as the average man of forty, according to Dr. C. Ward Crampton.[2] On the other hand, he may present the common picture of the old man of eighty—old, weak, and miserable. Whether a man is old or young at sixty depends much upon his diet.

Dr. Crampton states that the foremost nutritional deficiencies in the mature and aging are calcium, iron, proteins, vitamins of the B complex, and vitamin A. Seventy-five percent of the men of sixty suffer a lack of one or more nutrients. The American diet is especially deficient in calcium. This deficiency becomes more and more serious as the years pass and the individual grows older. Iron deficiency, or secondary anemia, is the next most common nutritional defect in aging. Also, the aging man often becomes protein-poor. On the other hand, he may suffer dietary excesses, notably in carbohydrates.

He advises that the calories must be cut down as one grows older. The decrease in natural activity between ages thirty-five and sixty calls for a reduction of fuel food, but even if the activity is the same at sixty as it was at thirty, the basic energy requirements have diminished 33 percent. Lean men have a greater life span and remain young, active, and healthy longer.

It no doubt is highly desirable for older people to aim to meet the Nutrition Yardstick in the various nutrients, except in calories from carbohydrates. Those people who are cutting down on their food volume must be especially careful. They have the problem, similar to that of the person who is reducing, of meeting their vitamin, mineral, and protein needs. The chart on page 193 shows the changes in nutritional needs of a man of sixty years.

For some years, Professor Henry C. Sherman of Columbia

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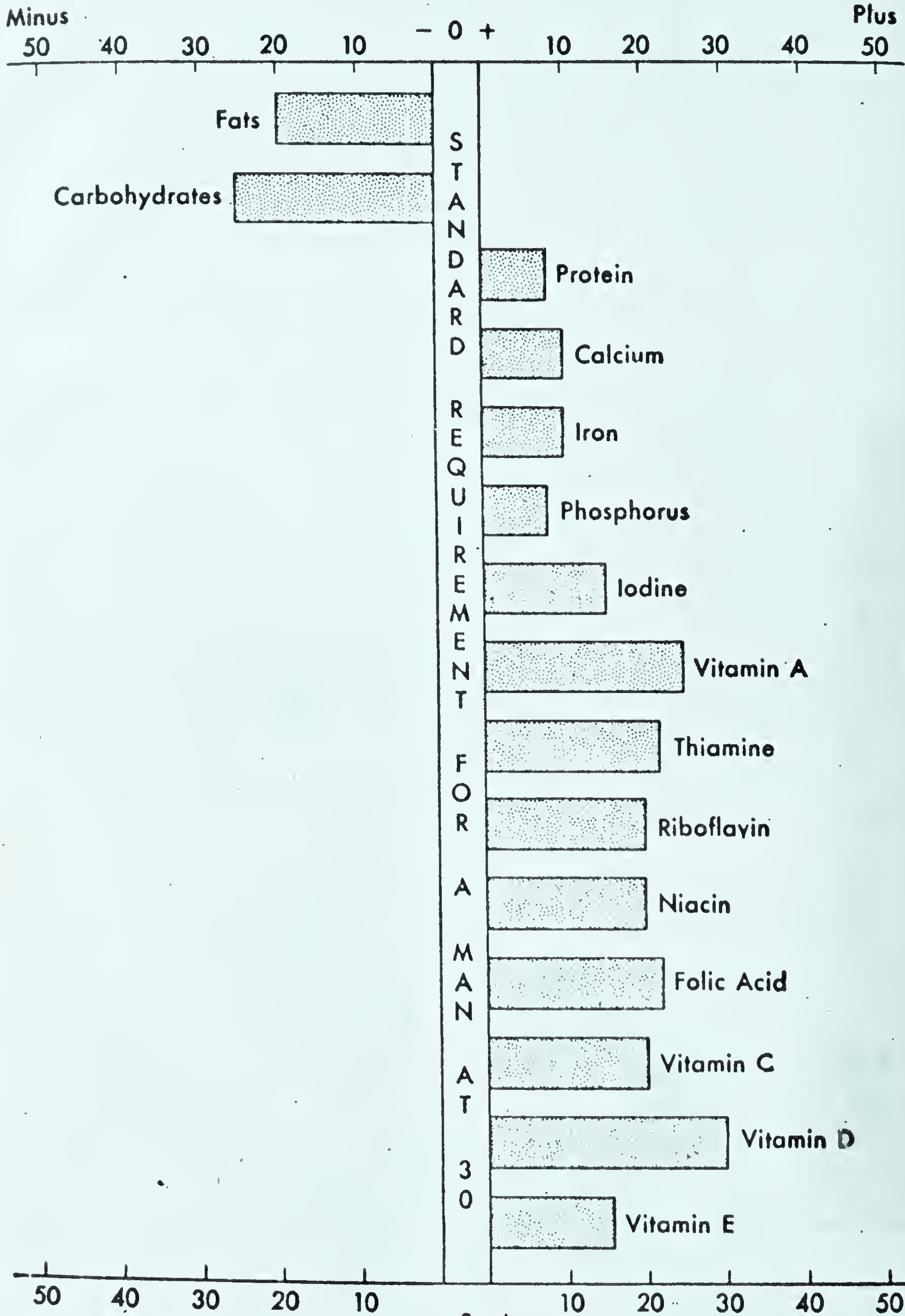
[2] C. Ward Crampton, "Dietary Aids and Dangers for the Aging," *Meals for Millions*, Final Report of the New York Joint Legislative Committee on Nutrition, Albany, N.Y., 1947, pp. 115–127.

Changes in Amounts of Nutrients Needed After Age 60



Courtesy Dr. C. Ward Crampton

Older people need less carbohydrates and fats and more protein, minerals, and vitamins in the proportions indicated in this chart.

University has been maintaining a race of more-than-well-fed white rats in his laboratories. They have become mature more quickly and live longer on a diet high in vitamins, minerals, and protein. Yet these rats do not age early. Instead, they maintain the full vigor of their prime of life into the period when other animals, kept on a merely adequate diet, become definitely senile. Professor Sherman feels that comparable results could be achieved with human beings, bringing on the vigor of adulthood earlier and making it last into the years that are too often wasted in the sicknesses and ailments of old age. It appears that perhaps ten years may be added to the life of a person who lives in accordance with today's newer knowledge of nutrition.

Dr. C. M. McCay of Cornell University has conducted a series of experiments with rats, covering their whole lifetime. Those rats which were kept on a low-carbohydrate ration from earliest youth onward lived to an age corresponding to a human life of 100 to 150 years. Maybe we have something to learn from these and other experiments which are being undertaken by scientists.

For Review

1. What is meant by a "complete" breakfast? A "complete" lunch? A "complete" supper?
2. What are some of the reasons why people do not eat adequate meals for breakfast? For lunch?
3. What values are there in eating between-meal snacks? What should be included in between-meal snacks?
4. Give suggestions for a good packed lunch. Specify for whom it is intended.
5. Discuss the subject of school lunches.
6. How can the home and the school work together so that the home and school diets will supplement each other?
7. How can proper food habits be established in children?
8. If something important nutritionally is lacking in meals on one day, can it be made up in the next day's meals?
9. How can mealtime be a happy experience for children and adults?
10. What kind of diet do you suggest for a football player? Should his diet differ from that of nonathletes?

For Personal Application

1. Analyze a full day's diet (your own, a relative's, or one which you have made up) as described in this book. Use the arrangement illustrated in the Appendix, page 366. Indicate in what respects each meal, and the day's total food intake, is satisfactory or unsatisfactory.
2. What improvements can be made in the diet analyzed in item 1 through substitutions, additions, and eliminations in that diet?
3. When you eat between meals, how well do these extras help to round out your day's diet? Or do these snacks contribute to unbalancing your diet?
4. Make a study of the breakfast habits of a number of people—schoolmates, family, friends. What conclusions do you draw from this study?
5. Do the same as in item 4 for (*a*) lunches, (*b*) between-meal snacks, and (*c*) beverages.
6. Observe the lunch trays in the school cafeteria to discover whether the students are selecting their lunches so as to get their money's worth in food values. What suggestions for improvement can you make?
7. Plan the refreshments for a party in your home.
8. Plan a day's menu (*a*) for camping; (*b*) for a hike or a picnic.
9. Study the two family food plans on pages 378 and 380. Then determine what your particular family needs to purchase for a week for (*a*) the low-cost plan and (*b*) the moderate-cost plan.

12

DIGESTION IS A STORY OF CHEMICAL CHANGE

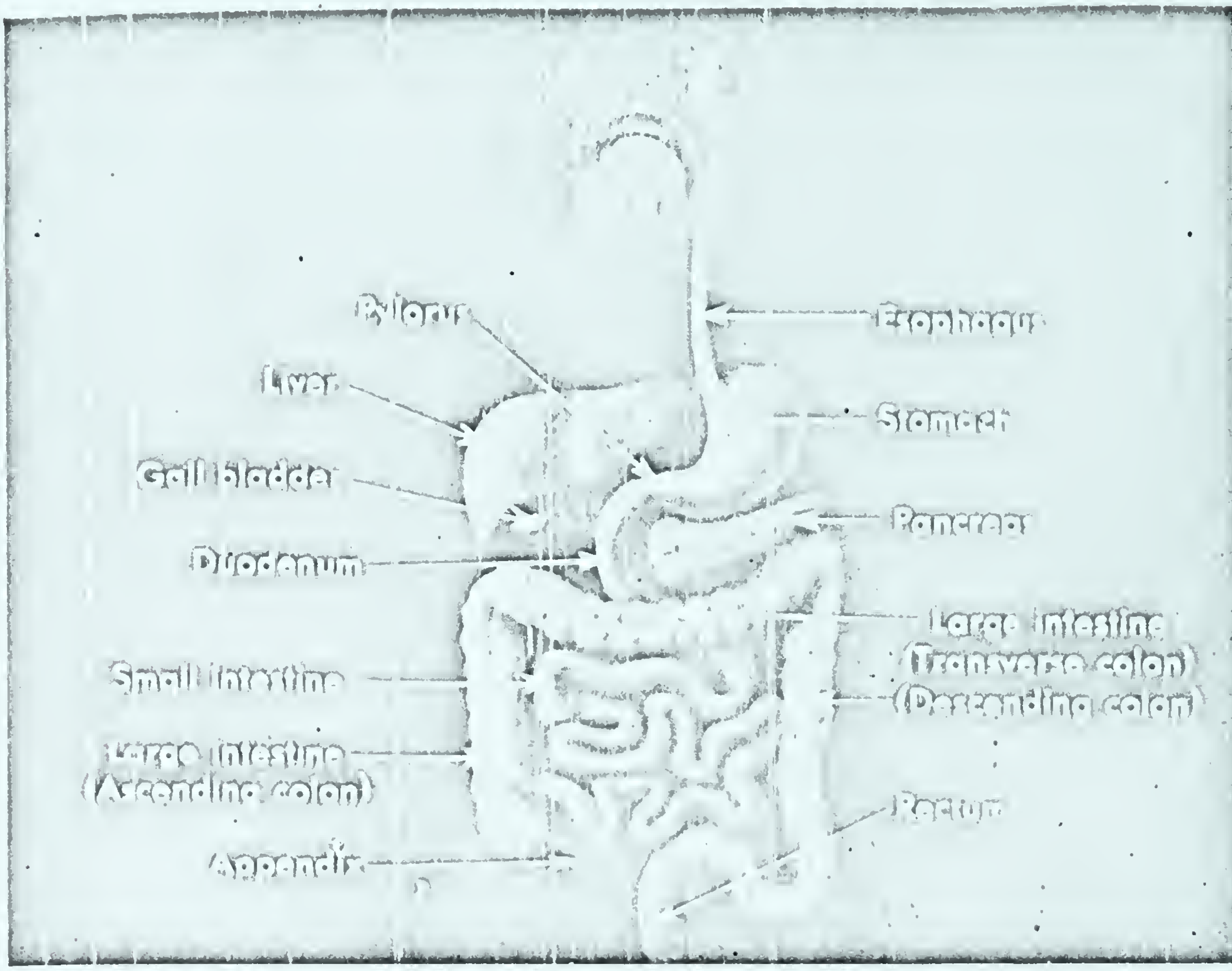
> We know that a lot of people who are regarded as poor prospects for jobs need food. They are set down in personnel records as lazy and dumb. What is really wrong with them is that they are hungry.
>
> PAUL V. MCNUTT[1]

The story of digestion is an explanation of what happens to food after it is placed in the mouth. It is an interesting story of chemical change going on in our own bodies.

Most of the scientific facts of digestion are difficult to understand and are of importance mainly to the physician and the physiologist. However, the following simple facts should help you to understand better your own body functions as related to food and nutrition.

Digestion may be defined as *the process by which the complex foods that we eat are transformed into simpler substances which can be absorbed*

[1] Former Administrator, Federal Security Agency and Director, War Manpower Commission during World War II.



From the Encyclopaedia Britannica film "Digestion of Foods"

The digestive system is made up of many organs. Those that are a part of the alimentary canal are listed on page 199.

into the blood stream and carried to the cells of the body. It is not possible for food to be absorbed into the blood stream in the form in which it is swallowed.[2] Therefore, it must be acted upon by various juices and processes so that our bodies can make use of it. These actions and processes constitute digestion.

Digestion is primarily a series of chemical changes, although considerable mechanical action—such as chewing, swallowing, and the movement of food—assists in the digestive process.

The organs which help in the various steps of transforming foods into absorbable substances make up our digestive system. This system consists of (1) a long tube called the alimentary canal and (2) a number of additional organs which are connected to the alimentary canal or are a part of it. The alimentary canal is

[2] About the only substances which pass directly into the blood from the digestive system without being changed are alcohol, water, and dextrose—a simple form of sugar.

about 30 feet long, or over five times a person's height. Most of it is coiled up in the abdominal cavity. The time that it takes for the passage of food through the entire length of the digestive tract is between 20 and 30 hours.

The Breakdown of Food

The breakdown of food is a complicated process made up of a series of many steps. Consideration will be given here only to the final products of the digestion of food and the substances, known as enzymes, which assist in the process.

The end products of digestion. The final results of digestion are known as end products. These end products are the chemical substances which can be absorbed through the lining of the intestines into the blood stream. The end products of digestion are as follows:

1. Simple sugars (dextrose and levulose) from carbohydrates
2. Fatty acids and glycerol from fats
3. Amino acids from proteins
4. Minerals and vitamins (Many of these, in chemical combination with other substances in food, are released in the process of digestion. Others apparently undergo no chemical action or change in the digestive system, being absorbed in the chemical form in which they are eaten.)

These end products, in the form of simple sugars, fatty acids, amino acids, as well as minerals and vitamins, are then ready for absorption into the blood stream.

The functions of enzymes. Digestion in the human body takes place under the influence of substances which act as chemical catalysts and are known as enzymes. Many kinds of enzymes are found in the digestive system, each one performing a specific step in the chemical breakdown of carbohydrates, fats, and proteins. Digestion occurs best at normal body temperature.

It is of interest that chemical changes similar to those of digestion can be brought about in the laboratory by boiling food in acids, by the action of alkalies, or by subjecting the food to superheated steam.

When we are getting ready to eat—if the food or meal is one which we like—our nervous system telegraphs the message to the salivary glands of the mouth and to other glands of digestion, and so the digestive juices with their enzymes start to flow.

The senses of smell, sight, and hearing—each as connected to previous associations with specific foods, meals, and places of eating, and to the anticipated taste of the food—assist in the stimulation of the flow of the digestive juices. Strong emotions, such as anger and fear, have an inhibiting effect on the flow of the digestive juices—that is, they prevent the digestive juices from flowing properly.

The Digestive System

The part of the digestive system known as the alimentary canal is made up of, in sequence, the mouth cavity, the pharynx, the esophagus, the stomach, the small intestine, and the large intestine. The two principal additional organs of digestion are the liver and the pancreas, both of which connect to the small intestine.

The mouth cavity. The food which we eat is made up of carbohydrates, fats, proteins, minerals, vitamins, water, and roughage. The food is first masticated, or chewed, in the mouth. During mastication saliva is poured into the mouth and mixed with the food to moisten and lubricate it. In the mouth, the enzyme of saliva, known as ptyalin, converts the starch in food into dextrin, which has a slightly sweet flavor. Chewing starchy foods sufficiently will bring out this sweet flavor more definitely.

Mastication is very important because it promotes the flow of saliva and divides the food we take into our mouths into small pieces so the digestive juices may act more readily and thoroughly upon it. The teeth, of course, aid in cutting and grinding and in the general mastication of food so that the rest of the digestive system can more readily carry out its function. When your teeth are good, you can chew or masticate all kinds of food; and, since it is necessary to have a varied diet, it is important that we develop and maintain sound teeth.

From the Encyclopaedia Britannica film "Digestion of Foods"

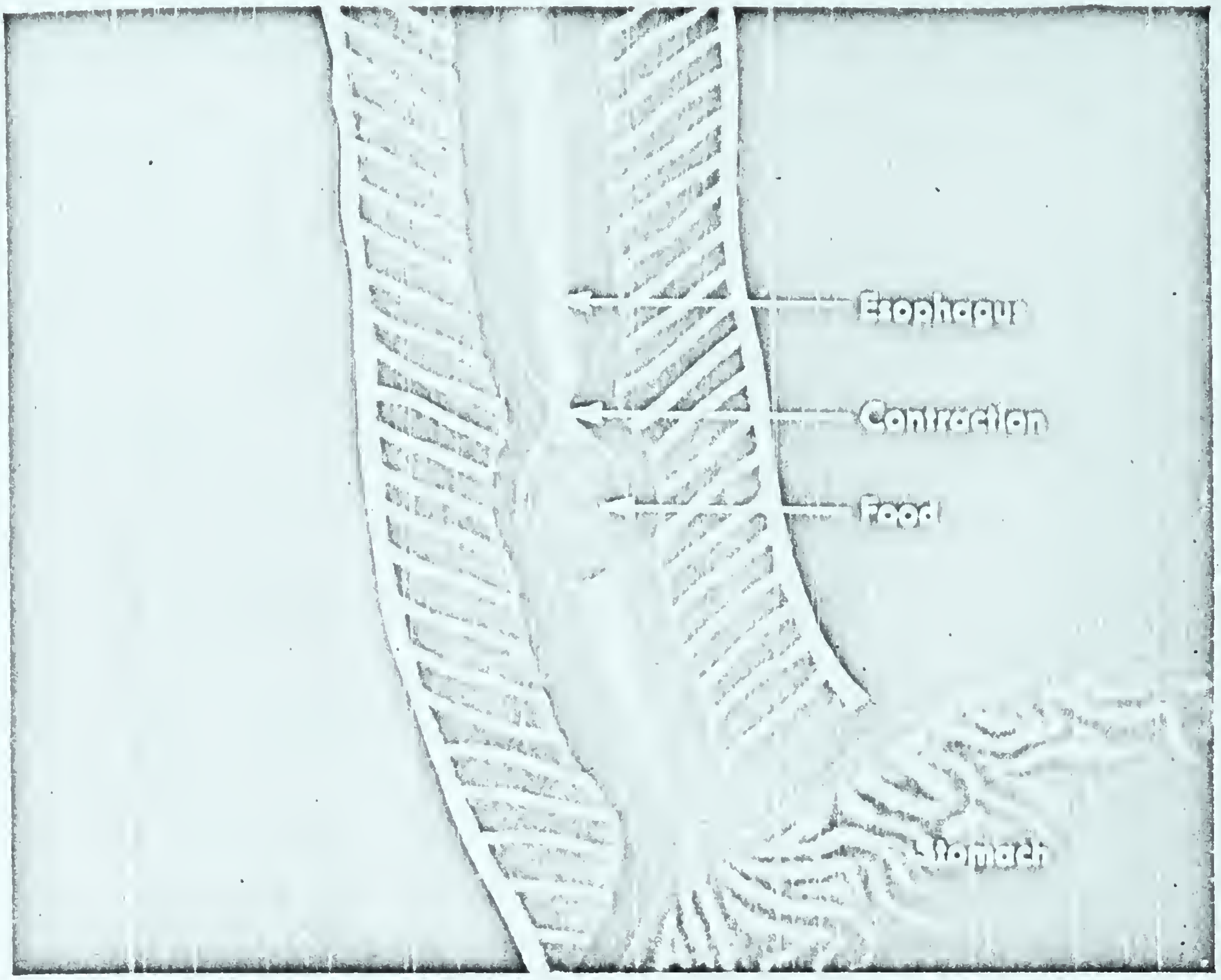
Three pairs of salivary glands supply the necessary enzymes for preliminary digestion of starch, or food, in the mouth.

The tongue is the organ of taste. It contains four different types of taste areas, or nerves—namely, sweet, sour, bitter, and salt. The tongue helps with digestion by mixing and moving the food around in the mouth.

When food is in our mouths, we are able to identify it through a combination of taste, temperature, and a feeling of the texture, shape, and size of the food. Frequently we confuse smell with taste. Food seems not to "taste" as good when we have a cold because we do not get the aroma from the food. Flavor is a combination of aroma and taste.

The pharynx and esophagus. After food has been chewed, it is swallowed by passing through the pharynx, or throat cavity, in which are located the tonsils and the vocal cords. The pharynx connects with the esophagus, or gullet, which is a 9- to 10-inch tube connecting with the stomach.

The walls of the esophagus contain a muscular layer which



From the Encyclopaedia Britannica film "Digestion of Foods"

Food is moved through the esophagus to the stomach by means of wavelike muscular contractions, known as peristalsis.

aids in moving food to the stomach. This muscular action works in reverse in the case of vomiting—that is, it moves the food up into the mouth cavity rather than down into the stomach.

The stomach. It takes about 1 second for food to pass from the esophagus into the stomach, which serves as a temporary storage place for it. The capacity of the normal adult stomach is about 3½ pints. The stomach is really a muscular organ, a somewhat widened part of the alimentary canal, which is capable of changing considerably in size and capacity in proportion to the size of the contents. When there is no food in it, the stomach is contracted; as food enters the stomach, it is enlarged just enough to hold the amount taken in.

Saliva, which was swallowed with the food, continues the digestion of starch for a while in the stomach; but it is in the stomach that the digestion of proteins and, perhaps, fats begins. In order to perform this part of the process of digestion, the

From the Encyclopaedia Britannica film "Digestion of Foods"

Food is moved around in the stomach during digestion by means of wavelike motions, or peristalsis. The arrows indicate the contractions taking place in the stomach of a human being.

stomach is provided with gastric juice that is produced by several million small glands which line the stomach wall. The enzymes of the gastric juice aid in changing the food into a semi-liquid known as chyme.

Every 20 seconds or so during digestion muscular waves, or contractions, slowly pass along the walls of the stomach. This process is known as peristalsis. These waves aid in moving the food, when sufficiently digested, into the upper part of the small intestine, known as the duodenum. There are similar waves in the small and large intestines which help to mix the food and then to move it along after it has been acted on and is ready to pass. These peristaltic waves are automatic. Their strength and frequency are influenced by the tone of the digestive muscles. The tone of the muscles is, in turn, influenced by the general health of the individual.

The time required for the food to move through the stomach varies from 1 to 6 hours or more, depending upon the type and

amount of food eaten. Fats remain in the stomach longer than either proteins or carbohydrates, and for this reason fatty foods give a feeling of fullness longer than do foods lacking in fats. The average time for digesting an ordinary mixed diet is about 4 hours.

Strong emotions, such as anger, pain, worry, and dislike for foods, may cause a delay in the digestion by inhibiting the flow of digestive juices. Active physical exercise soon after a meal also may inhibit or slow down digestion by its demands upon the blood supply for the large muscles. When stomach digestion is delayed, microscopic organisms may cause fermentation of the sugars in the food. This fermentation causes gas to form, which results in distress to the individual.

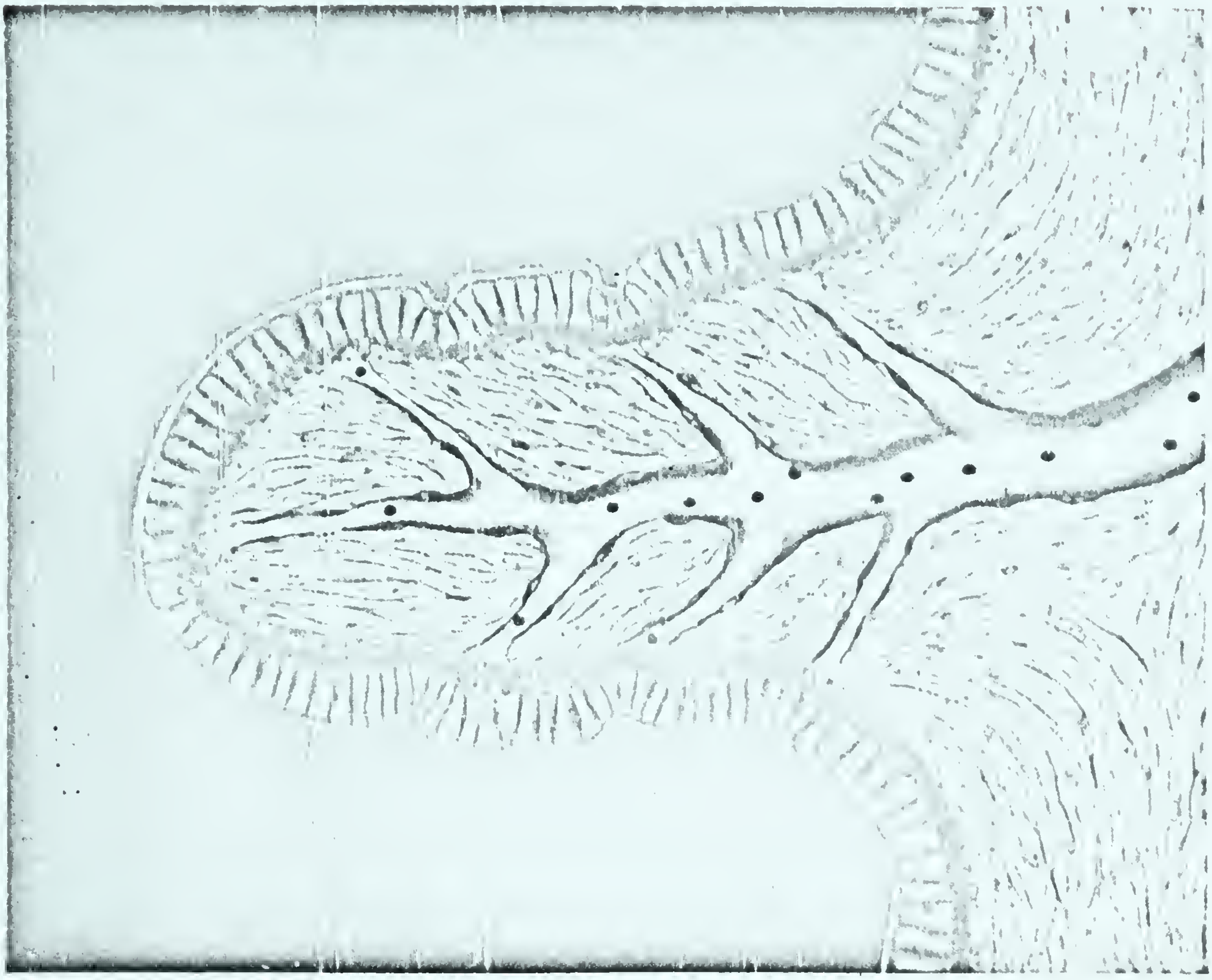
The small intestine. After the food leaves the stomach, it passes to the small intestine where the greatest digestive changes occur. The small intestine is approximately 23 feet long. It is about 1½ inches in diameter at its beginning and not much more than an inch at its lower end, where it connects with the large intestine.

The small intestine has minute glands located on its surface which supply enzymes. The liver and the pancreas are connected by ducts to the upper part of the small intestine. Their secretions aid in the digestion of food in the intestine.

Carbohydrates, proteins, and fats are broken down into their end products in the small intestine with the help of enzymes from the liver and the pancreas. Amino acids and simple sugars, as well as vitamins and minerals, are absorbed into the numerous blood vessels located in the walls of the intestine. The end products from the digestion of fat are absorbed into the lymph vessels and conveyed to the liver.

The peristaltic action in the small intestine mixes the digestive fluids with the food, brings absorbable material, or end products, constantly to the wall for absorption, and moves food along the length of the small intestine. The food which has not been digested or absorbed enters the large intestine.

The liver. The liver is connected to the beginning of the small intestine. It is the largest gland in the body, weighing, on the



From the Encyclopaedia Britannica film "Digestion of Foods"

Digested food is absorbed through the walls of the small intestine by thousands of villi and is transported by the blood or the lymph to other parts of the body. This picture shows one villus many times enlarged.

average, about 3 pounds, and has these important functions:

1. It produces bile. Bile is made up of certain body wastes and a secretion which aids in the digestion and absorption of fat. Bile is stored in the gall bladder between periods of digestion. From there it empties into the upper part of the small intestine.

2. It works with the pancreas to control the concentration of glucose, or sugar, in the blood. Glucose, obtained in the digestion of carbohydrates, is changed into glycogen which is stored in the liver until needed in some other part of the body. The glycogen is then converted back into glucose which is transported by the blood to the places where needed. The muscles use up the greater portion of the glucose produced, but all cells need some glucose. Glycogen is sometimes called "animal starch," since its chemical formula is similar to that for starch.

3. It provides a storage place for iron, copper, and vitamin A.

4. It regulates the concentration in the blood of the various amino acids obtained from protein. When there is an excess of certain ones over the needs of the body at the time, the nitrogen part is split off in the form of ammonia. The ammonia is converted into urea and eliminated from the body by the kidneys. The nonnitrogenous part of amino acids is changed into glucose to be burned in the body or converted into body fat, depending upon the amount of carbohydrate and fat otherwise in the diet. The use of protein in this way, however, is not economical, since carbohydrates or fats are less expensive. (See page 86.)

The pancreas. The pancreas, like the liver, is connected to the upper part of the small intestine. It weighs about 2 to 3 ounces. It produces two secretions:

1. The pancreatic fluid, which aids digestion after it reaches the small intestine.

2. Insulin, which is absorbed directly into the blood stream flowing around the pancreas. Insulin helps to regulate the concentration of sugar in the blood. Following meals which are high in starch and sugar, there will be an increase in the sugar, or glucose, content of the blood. The amount of sugar in the blood later returns to normal under the action of insulin. Diabetes is a disease related to the body's use of carbohydrates and the production of insulin. The sugar absorbed from the digestive system cannot be stored as sugar and so must be converted into glycogen.

The large intestine. The large intestine is about 5 feet long. It has a diameter of 2½ inches at its beginning. It consists of four parts: the caecum, to which the appendix is attached; the colon, comprising the ascending, transverse, and descending parts; the rectum; and the anal canal. The large intestine has the following functions:

1. It continues with the process of digestion in a limited way. Although no enzymes are produced in the large intestine, the food transferred to it from the small intestine contains enough enzymes to make some further digestion possible.

2. It continues with the absorption of the end products of digestion to a limited extent. The greatest absorption of water occurs here.

3. It eliminates the waste products from the digestive system in the form of feces. This process is known as defecation. The feces consist of water, undigested and indigestible food, large numbers of bacteria, the products of bacterial decomposition, and the excretions from the liver and the other digestive glands. The large intestine serves as a temporary storage place for the food waste until it is eliminated. Various stimuli, according to one's individual habits, will initiate defecation.

Certain organisms in the large intestine cause the putrefaction of proteins which have not already been digested and absorbed. Some of the resulting by-products are eliminated in the feces; others are absorbed and carried to the liver, there to be changed into less toxic substances.

As previously mentioned in the discussion on vitamins, some of the B vitamins, as well as vitamin K, are synthesized by bacteria in the intestine.

The Urinary System

Although not a part of the digestive system, the urinary system is here included because it has the function of ridding the body of its soluble waste products of protein metabolism. The organs making up the system are the two kidneys, the two ureters, the bladder, and the urethra. The kidneys are located in the upper part of the abdominal cavity, one on each side of the backbone. Each kidney weighs about 8 ounces. Considering their small size, the kidneys perform an unusually large amount of work.

The kidneys are made up of millions of small tubules in close association with capillaries of the circulatory system. This arrangement serves as a selective filter, holding back the normal parts of the blood while permitting the waste products, which are in solution, to pass into the tubules and eventually into the bladder. Much of the water which is used to transfer the urea and other waste products into the tubules is reabsorbed into the blood stream.

About 1½ to 2 quarts of urine is excreted daily. About 95 percent of this is water. When sufficient water is not supplied

during and between meals, the urine may become concentrated, dark in color, and irritating. Excessive perspiration may also reduce the amount of water available to the kidneys.

The two ureters are tubes which convey the urine from the kidneys to the bladder. The bladder stores the urine until it is removed from the body through the urethra.

Through an examination of the urine, called a urinalysis, it is possible to determine whether or not the kidneys are doing their work properly. Urea is the main solid dissolved in urine. It is a normal by-product in the metabolism of proteins.

Albumin in the urine is not normal and may indicate that the kidneys are diseased. The presence of sugar in the urine shows that carbohydrates are not being oxidized properly, as is the case in diabetes.

A more recent use of urinalysis is as a means of checking up on the nutritional status of the individual. This procedure applies in particular to certain of the water-soluble vitamins, such as the B group.

A urinalysis should be a regular part of the periodic medical examination.

For Review

1. Name the parts of the alimentary canal and give their main functions.
2. Name several types of end products of digestion.
3. What are the functions of enzymes?
4. What is meant by peristalsis?
5. What are the functions of the liver?
6. What is insulin?
7. What is the relationship of the urinary system to food metabolism?

For Personal Application

1. Examine the digestive system of a laboratory animal, such as a guinea pig or a chicken.
2. Examine slides of various parts of the digestive system.
3. Examine X-rays of the stomach and intestines. Of special interest would be a series of pictures taken at different time intervals of the same stomach showing the passage of food.

4. Demonstrate the action of an enzyme in the following way: Heat a teaspoonful of starch in a pint of water. The starch paste obtained is opalescent. Place an equal portion of the starch paste in two test tubes. To the first add 100 cubic centimeters of saliva, which has first been filtered through coarse filter paper. Let stand for 40 minutes. Note the loss of opalescence in this tube. Now add a few drops of iodine solution to both tubes to test for the presence of starch. Note color change in the second tube, indicating that starch is present. No change occurs in the first tube, indicating that the enzyme in saliva has changed the starch into maltose.
5. Study the action of pepsin and other enzymes. Information about such experiments can be obtained from textbooks on physiology and chemistry.

13

MANY HEALTH ASPECTS ARE RELATED TO OUR FOOD

> If all that we know about nutrition were applied to modern society, the result would be an enormous improvement in public health, at least equal to that which resulted when the germ theory of infectious disease was made the basis of public health and medical work.
>
> FRANK G. BOUDREAU, M.D.[1]

The following health areas and health problems need special consideration as they relate to nutrition and digestion: appetite, the role of water and salt, the importance of sound teeth, common disorders of digestion, food allergies, effects of stimulants in common beverages, and the effects of alcohol.

Two additional topics—reducing and gaining weight—are considered separately in the next chapter.

[1] Chairman, Food and Nutrition Board, National Research Council; Director, Milbank Memorial Fund.

Courtesy "Junket" Brand Foods

Food habits learned in very early years may last throughout a person's lifetime. For this reason the training of young children in desirable food habits is of great importance.

Appetite and Hunger

Appetite and hunger should not be confused. Hunger is a physiological expression of the need for food. Emptiness is the common cause of hunger. Hunger is usually expressed by a general feeling of weakness and restlessness and by actual pangs in the stomach. Appetite, in contrast, is primarily a psychological desire for food. The two usually occur together in normal, healthy, active individuals. Ordinarily, hunger sharpens the appetite and makes us more eager to partake of the next meal.

Hunger might be described as a craving for food—food of any kind—whereas appetite is a sensation which enables a person to enjoy his food and to select the foods that he considers tasty and pleasant.

Appetite may be present even when there is a complete absence of hunger. For example, a person may have eaten a very large meal and yet will have an appetite for additional helpings

of some tasty dish. Habit also has an effect on appetite—for a person usually wants his food at his regular mealtime, even if he is not hungry. On the other hand, a person may feel quite hungry but if offered a dish of food to which he was not accustomed, such as snails, he most likely would not have any appetite for them.

A good appetite helps in the digestion of food. A good appetite is obtained through physical activity in work or play and through adequate rest. The child or youth who has been playing vigorously is likely to come to dinner ravenously hungry and does not show any peculiar food likes and dislikes. The greater the hunger, the less critical he is of the food available.

Thiamine helps to promote a good appetite. In contrast, sweets, such as candy, lower one's appetite for the more nutritious foods. Therefore, if sweets are to be consumed, it should preferably be at the end of a meal and not before.

It is important to give foods and meals "appetite appeal" so that they will be eaten and enjoyed. We should recognize the importance of palatability, which is determined by color, flavor, taste, aroma, texture, form, and shape. If a meal is not palatable, it is less likely to be eaten or to be well digested. The table should be set neatly, and the food should be served with good table etiquette in mind.

The Role of Water and Salt

In addition to the 40 or more nutrients listed on page 11, oxygen—for respiration—and water are two additional chemicals needed by the body to maintain life. These two chemicals might also be classified as nutrients, but by custom are not. Attention is here given to the place of water in our diet. Table salt is also discussed, since its role is closely related to the water needs of the body.

Water. The human body is about 70 percent water, with the soft tissues containing up to 90 percent. Blood and lymph are, of course, mostly water. It is possible to lose all our reserves of body fat and about one-half of our body protein without danger, yet a 10 percent loss of our body water is serious and a 20 percent loss

may be fatal. When we are not getting enough water, our sense of thirst leads us to relieve it. Usually, however, we need more water than most of us thirst for.

Thirst differs from both hunger and appetite. The sensation of thirst seems to be localized in the back of the throat, where one experiences a feeling of dryness when the body is not getting sufficient water.

Water serves as a medium for the transportation and interchange of the various chemicals of the body. It has these specific functions:

1. It carries the dissolved end products of digestion—such as dextrose, amino acids, minerals, and vitamins—from the digestive tract to the cells, where they are used or stored.

2. It transports dissolved wastes, which are produced in all cells, to the organs of elimination—the kidneys, skin, lungs, and liver.

3. It moves the hormones and enzymes from the glands in which they are produced to the points where they are needed.

4. It even transports heat produced in the cells—particularly in the muscle cells—to other parts of the body. When the body makes more heat than is necessary to maintain the normal temperature of 98.6 degrees, the excess heat is moved to the skin. There water, in the form of sweat, further assists in the cooling process, for each ounce of sweat requires about 16 calories of heat in order to evaporate, and most of this heat is taken from the body. Water does not itself contain any energy—calories—as do fats, carbohydrates, and proteins.

When we consider the many functions of water in our bodies, the importance of developing the water-drinking habit to be assured of getting our daily supply is apparent. In general, children need about four glasses a day and adults from four to eight glasses. However, the amount which you actually need is dependent upon (1) the temperature of the air, (2) the humidity of the air, (3) the amount of water contained in your food, (4) the amount of exercise, and (5) the size of your body.

Under normal conditions, the amount of water in our bodies stays about the same, even when our intake varies. If we increase

our intake above normal, the kidneys help to dispose of the excess.

Experts state that, when people work at high temperatures with considerable sweating, their best performance can be maintained if there is an hour-by-hour replacement of the water lost in sweat. If this is not done, there may be serious inefficiency in a matter of hours and eventually exhaustion.

The water content of the human body comes from these other sources, in addition to the several glasses of water which we may drink each day:

1. Other liquids, such as beverages, soup, and fruit juices, supply water. These foods are largely composed of water. They therefore serve the same purpose as drinking water.

2. Foods of all types contain variable amounts of water in their cells. Fruits and vegetables have the highest content. The fact that foods can be dehydrated illustrates this point.

3. Water is formed in the cells of the body during the metabolism of sugar (dextrose), fats, and proteins, as discussed in earlier chapters. About one-third of our average daily water needs are supplied in this way, the other two-thirds coming from the other two sources and the drinking water.

Iced beverages and very cold food delay digestion and may cause a stomach upset. Iced drinks are particularly undesirable on hot days and immediately after strenuous exercise. It is also unwise to consume very hot beverages and foods. Digestion of food occurs best when eaten at the temperature of the body.

Salt. The water and salt needs of the body are related. The salt requirement of man in temperate climates is probably not in excess of 5 grams, 1/6 ounce, per day. The average diet, which has been found to contain 10 to 15 grams of salt, adequately meets this requirement.

In hot climates, where sweating is excessive, it is recommended that 1 gram of salt be consumed for each quart of water in excess of 4 quarts of total liquids. The salt requirement per day of individuals who have been accustomed to working in hot climates is reduced through the lowering of the concentration of salt in sweat.

Courtesy Carroll Van Ark and "Woman's Day"

On days that are warm enough, meals can be eaten outdoors, picnic style. "Extra salt, salty foods, and plenty of water" is the doctor's advice in hot weather.

When it is difficult to obtain sufficient salt through the regular diet or when individuals do not make an effort to increase their salt consumption during hot weather, salt can be added to the drinking water or, less satisfactorily, taken in the form of salt tablets.

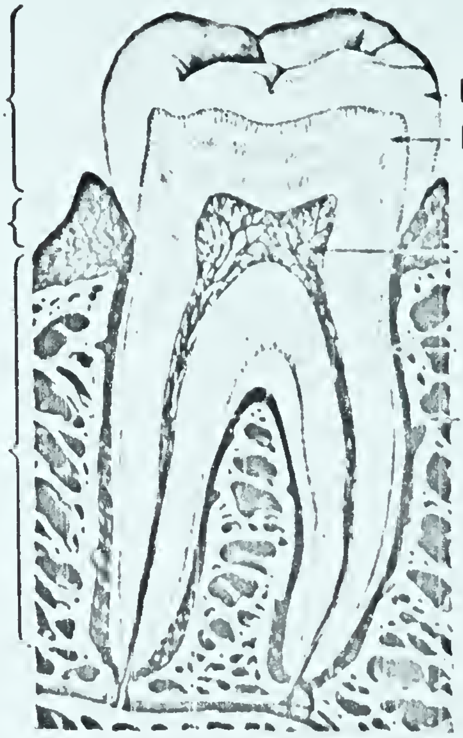
Table salt is now known to be one factor which may contribute to high blood pressure.

The Importance of Sound Teeth

Not only does diet affect teeth, but teeth affect the digestion of food. The relationship of various nutrients to the health and strength of the teeth has already been considered in previous chapters. Because sound teeth are so important to the digestion of food, we bring this information together so you can see the full picture of this relationship.

Almost half of the first two million men examined under the Selective Service Act in World War II were rejected because of various physical defects. The failure to meet dental requirements

Good nutrition is essential to normal tooth development. To reduce tooth decay, consume less of the refined carbohydrates—especially sugar.



Courtesy the American Dental Association

was the most frequent cause of rejection, accounting for 21 percent of them. This is a high rate when one recalls that the men—mostly under thirty years of age—who were rejected in this group needed only six back teeth and six front teeth to be accepted for the Army.

Other studies show that more than 90 percent of children six years of age have some decay—dental caries—in the temporary set of teeth and that more than 80 percent of children who are fourteen years of age have one or more carious permanent teeth. Caries, or decayed teeth, is the most prevalent of all diseases, affecting 97 percent of our population.

The tooth enamel is the hardest substance in the human body. When decay does penetrate the enamel, it develops faster in the softer underlying dentine. The tooth structure which lies below the gum line is also subject to decay when tartar collects on a tooth and forces the gum to recede from its contact with the tooth at this point.

Of the major methods involved in the prevention and control of tooth decay which have been advocated by authorities, we shall consider diet, brushing the teeth, and the use of fluorides, since each of these methods has something to do with what we eat or drink. The fourth method, that of dental care, while very important, will not be discussed here.

Courtesy the American Dental Association

Having an X-ray made of the teeth is the only way to discover a number of hidden conditions that may need attention. Your dentist will decide whether or not an X-ray is necessary when he makes the periodic examinations of your teeth. You should have such examinations every 6 months.

Diet and teeth. That tooth structure is dependent upon the kind of food eaten has been demonstrated on laboratory animals by feeding them on diets which were definitely deficient in one or more of the calcifying substances. The materials, or nutrients, which go into the building of the teeth largely determine the character of the teeth, and these materials come, of course, from the food which we eat. Some authorities believe that the incidence of tooth decay is one of the more reliable evidences of one's nutritional state.

There are five nutrients which are especially important for the building of sound teeth—calcium, phosphorus, and vitamins A, C, and D. Vitamin D is essential to normal bone growth and tooth development, since it regulates the metabolism of calcium and phosphorus. Vitamin C is important in maintaining the health and resistance of the teeth and also helps to prevent the

gums from bleeding. Vitamin A assists in the growth of the teeth. It is also desirable that some foods be included in the diet which require mastication in order that certain benefits be derived from the more forcible use of the jaws.

Good nutrition is most important while the teeth are developing. A prospective mother should be sure to get an adequate diet, since her food during the prenatal period helps to determine the quality of the teeth of her child. In contrast, it is not believed today that the *inclusion* of the important foods after the teeth are formed will prevent decay, but rather that it is the *exclusion* of refined carbohydrates which is the most significant factor.

Brushing the teeth. Keeping the teeth clean by proper and regular brushing is part of mouth hygiene. Brushing the teeth is important for the following reasons: It is believed that tooth decay is caused by acids formed by microorganisms in the mouth which act on the film of food adhering to the teeth. The carbohydrates—starches and sugars—are the nutrients which are rapidly converted into acids by these mouth organisms.

These facts suggest two procedures for the individual to follow in preventing acidity in the mouth: (1) Brush the teeth immediately after each meal, if possible, and before going to bed, with special attention when sweets have been eaten. (2) Consume less refined carbohydrates—sugar in particular.

Dental experts say that the use of the correct brushing technique is far more important than the kind of dentifrice used. If a dentifrice is used, one that contains an abrasive is more effective than any other type of dentifrice.

Regular visits to the dentist for the purpose of having the teeth cleaned and cavities filled are, of course, essential.

Fluorides to prevent dental caries. One of the dramatic developments in the prevention of tooth decay has been the discovery that the presence of fluorine compounds in small quantities in drinking water results in an appreciable decrease in the incidence of dental caries. An excessive amount results in the discoloration of the enamel on teeth. The amount required to discolor the teeth is much in excess of the quantity which will inhibit the development of caries. In localities where fluoride has been

added to the drinking water, there has been a considerable decrease in the amount of caries in the population. The way in which the teeth are better preserved by fluorides is not clearly understood at present.

The local, or direct, application of sodium fluoride to the teeth, after the teeth have been cleaned in the regular manner with pumice and a polisher, has resulted in a 25 to 40 percent decrease in dental caries.

It is recommended that, beginning with the age of three years, the child's teeth should have a proper and thorough cleaning by a dentist at least twice a year, and that immediately following the cleaning at the ages of three, seven, ten, and thirteen, a 2 percent solution of sodium fluoride should be applied. The American Dental Association and the U.S. Public Health Service recommend that each series of fluoride treatments should consist of four applications at weekly intervals. To be effective, the treatment must be given while the teeth are developing. Sodium fluoride will not stop decay once it has started, and it cannot be predicted with any accuracy which children will receive most benefit from its use.

Experiments are also being conducted to determine whether the deliberate addition of fluorides to drinking water will result in a decrease in caries, and thereby be a means of protecting the children of whole communities against the ravages of tooth decay.

One such experiment was conducted in Newburgh and Kingston by the New York State Department of Health. These two cities have comparable water supplies, economic statuses, and sources of common food supply. Newburgh had its water treated with sodium fluoride over a number of years. Kingston continued to use its fluorine-free water. The results of this experiment showed that the children in Newburgh, where the water had been treated, had fewer tooth caries than those in Kingston.

It is suggested that you keep informed about these and similar experiments as they are reported in papers and magazines. While you may be too old to profit from these new developments, at least your children should benefit from them.

Common Disorders of Digestion

There are many signs that indicate trouble in the digestive system—upset stomach, stomach-ache, gas, heartburn, no appetite, nausea, vomiting, and bowel trouble. These symptoms may be a healthy body's way of expressing its natural rebellion against careless eating and drinking; they may be caused by a diseased digestive system; or they may result from disease in some other part of the body.

Many people do nothing when they have stomach trouble or do the wrong thing, such as reaching for a bottle of their favorite drugstore medicine. If stomach trouble puts you on the sick list time after time, be sensible and go to a physician. Follow his advice, even if it means changing your way of living, including your habits of eating. Do not depend upon your own diagnosis and treatment.

The effect of emotions on digestion. A person's mental state at meal time needs to be considered. Strong emotions, such as anger, fear, and worry, may have a bad effect upon appetite and, when occurring too often, may cause various digestive disturbances. Nervous indigestion is not just an imaginary ailment. It occurs in people who permit their nerves to get the best of them. Nervousness and tension on the part of an athlete may upset his digestive system, especially prior to and during a game.

Any kind of excitement is likely to act as an inhibitor of normal appetite, even excitement of a pleasant type. Children especially are affected by excitement.

Do not come to the table unless or until you are rested and ready to enjoy your food. Do not eat too heartily if you are tired or exhausted. Do not try to eat when angry or otherwise emotionally upset. Do not hurry at mealtime. Ample time for consuming each meal is as important as regularity of meal schedules.

Try to make eating a pleasant and happy time—a "fun-time"—for cheerfulness during eating speeds the digestive process. As someone has said, "A sauce of humor is as good as a sauce of mushrooms, as far as digestion is concerned." Keep the family meal hour for peaceful talk; settle disputes some other time.

From the McGraw-Hill filmstrip "Home Ground," courtesy Pathescope Corp.

Mealtime should be a pleasant and happy time for the family—not only because it is one of the few times when the family is together but also because a lack of tension is a necessity for the proper digestion of food.

When you are eating out alone, try to find a quiet, cheerful place for your meals.

Constipation. It has been estimated that 75 percent of all Americans are troubled with constipation. The amount of money spent annually on cathartics runs into many millions. Some of these people need cathartics, but no doubt many others are harmed by their use. Cathartics are harmful because they can become habit-forming. They are actually dangerous if used during an attack of appendicitis, because they increase the inflammation of the appendix and bring it closer to rupture. People who are regularly constipated should get the advice of a physician.

The following methods for preventing and overcoming constipation are recommended:

1. Have a regular time for defecation and act upon the desire. The body becomes accustomed to a time schedule which, in this instance, it is very important to maintain. This schedule should relate to the time of meals and to the time of bowel action. In the case of children, it is especially important that a regular schedule be developed and maintained. Persons whose working, sleeping,

and eating hours are irregular throw an added strain on their bodies by making it difficult to establish regular habits of defecation.

2. Include in the diet those foods which have bulk and roughage. Foods in this category are the fruits, vegetables, and whole-grain cereals. Some people, however, have to be careful not to include too much roughage in their diets.

3. Strengthen the abdominal muscles. Form the habit of daily exercise, with special attention given to these muscles. Also, general body health, including general exercise, helps to maintain the general tone of the muscles of digestion.

4. Drink plenty of water—6 to 8 glasses daily.

Mineral oil is not recommended as a laxative because it interferes with the absorption from the intestine of calcium, phosphorus, and vitamins A, D, and K. Mineral oil has no food value and does not contain the fat-soluble vitamins A and D which are found in animal fats. For these reasons the increased use of mineral oil in salad dressings, salted peanuts, potato chips, and doughnuts may have serious nutritional consequences.

Food Allergies

Allergy is a term used to describe sensitiveness to substances which are harmless to most persons. Translated from the Greek word from which it is derived, allergy means "strange disease." The offending substances causing allergies are called allergens. They may be grouped into three different classes: foods, inhalants, and contact substances. About 1 out of every 10 persons has some form of allergy.

The most common symptoms of allergy are hives, eczema, headaches, migratory swellings of the face, hands, and feet, indigestion, nausea, vomiting, diarrhea, asthma, and congestion of the nose.

There are many foods to which one may become allergic. Authorities[2] claim that wheat, milk, eggs, cabbage, tomatoes, oranges, and chocolate are the greatest offenders.

[2] James S. McLester, *Nutrition and Diet in Health and Disease*, W. B. Saunders Company, Philadelphia, 1943, p. 849.

Just what it is that causes a person to become sensitive to certain foods is still not understood. It is known that heredity is an important factor. However, members of the same family may be allergic to entirely different substances, or they may respond to the same allergens but the symptoms may be different.

It is sometimes very difficult to discover specifically what food or other substances may be the cause of an allergy. To do so, a study can be made of the conditions under which attacks occur, or skin tests can be made with extracts of the foods or other substances which are suspected of being the cause. Diets must be planned so as not to include the foods known or suspected of being the offenders. The doctor may recommend injections of the allergy-causing substance to help build up resistance to it.

Nature can be very adaptable. If a patient is first exposed to very minute amounts of the food causing the trouble, and then has the amounts gradually increased, he frequently becomes tolerant to that allergen.

Other offending substances, in addition to foods, which cause allergies include hair, feathers, pollen, perfumes, dyes, vapors, and smoke.

Effects of Stimulants of Common Beverages

Coffee, tea, and cocoa are commonly used as beverages in this country. In moderation they probably have no serious effects on the health of adults. In special instances, however, patients are advised by their physicians not to use coffee or tea. Young people of high school age are advised not to use either of these two beverages at all.

Both coffee and tea contain the stimulant caffeine, which is known as theine in tea. This drug is a stimulant to the heart and to the nerves. It raises the blood pressure and increases the activity of the kidneys and the intestines.

Coffee frequently enables a person to do more and better work with less fatigue. However, too much of the drug may in time affect people in various ways. They may not sleep as well; their muscles may partly lose their strength and endurance; and the

Courtesy Food and Drug Administration

Tea is tested for flavor by examiners in the Federal government. These examiners must develop taste buds sufficiently sensitive to be able to tell the difference in flavors among teas.

hands may tremble. Too much coffee may also result in headaches, ringing in the ears, irregularities in the heartbeat, and heartburn.

Through psychological studies it has been shown that the stimulating effect of coffee may last up to 3 hours. This observation might be taken into consideration in deciding when or when not to drink coffee, especially by those individuals whose sleep is disturbed when coffee is consumed too near bedtime.

Coffee taken with cream and sugar, or cream only, is considered less harmful to the stomach than unsweetened black coffee. It is also believed that coffee taken with meals is not so harmful as that taken between meals on an empty stomach.

The cocoa bean contains a drug known as theobromine which is similar to caffeine and has about the same effects on the body. Chocolate is made from the whole cocoa bean. Cocoa is made by removing the fat, which is known as cocoa butter. There is little food value in these drinks, except for the fat in the chocolate and the milk, if milk instead of water is used in preparing them.

Of the soft drinks, the kola drinks contain a stimulant which produces many undesirable effects similar to caffeine. Many such

drinks also contain phosphoric acid, which tends to etch the teeth.

Alcohol in Relation to Nutrition

The question is often asked as to whether alcohol, because of its high energy content, can be considered a food. Here are some well-established facts with regard to the nutritional effect of alcohol on our bodies.

Alcohol, like starch and sugar, is oxidized to yield energy, carbon dioxide, and water. One gram of alcohol furnishes 7 calories, as compared with 4 calories for 1 gram of carbohydrates and proteins, and 9 calories for 1 gram of fats.

Certain investigators have shown through research[3] that, within certain limits, alcohol can replace fats and carbohydrates as a source of energy in the diet. Alcohol, however, contrary to general belief, is not transformed into glycogen or fat and so is not itself stored in the body. Alcohol may contribute to increased body weight by stepping up the appetite and by causing the consumption of other energy foods found in alcoholic drinks, such as malt.

What happens to alcohol in the body is quite different from what happens to the other energy foods. Alcohol does not require digestion, as is the case with the carbohydrates and other nutrients. It is quickly and easily absorbed through the walls of the digestive system into the blood stream. When alcohol is taken with a meal or immediately after eating, it is absorbed much more slowly. For this reason the effects of alcohol taken after a meal do not show up so quickly as when it is consumed on an empty stomach.

About 5 percent of the alcohol leaves the body in the urine and the sweat or is exhaled from the lungs. This physiological fact provides a scientific way for determining whether or not a person has recently consumed alcohol. The remaining 95 percent is oxidized in the body.

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[3] Curt P. Richter, "Alcohol as a Food," *Quarterly Journal of Studies on Alcohol*, Vol. 1, March, 1941, p. 650.

Courtesy American Assn. for Health, Physical Education, and Recreation

"No alcohol" is the warning given to all athletes. Alcohol does not contribute to speed, strength, endurance, or skill.

Since alcohol is thus largely oxidized, it might be assumed that it would have special virtues as an energy food. However, the usual basis for determining the value of an energy food is the degree to which it is available for muscular energy. Investigations show that alcohol supplies very little energy for muscular activity. In fact, studies made of athletes and others after drinking lead to the opposite conclusion as to its value to muscular activity, since reaction time, muscular strength, and endurance are all impaired by the consumption of even small amounts of alcohol.

The reason why our muscles obtain little energy from alcohol is seemingly explained by the fact that the liver, which initiates the oxidation of alcohol, does this at a set, steady pace, without relation to the body's need for calories at the time. The liver does not increase its rate of action on alcohol, even if heavy exercise at the same time should increase the demand for additional energy for the muscles. By contrast, the body makes energy available from the other caloric sources in proportion to the needs at the time.

In earlier chapters the role of various B vitamins in the oxidation of carbohydrates has been discussed. There is conflicting

evidence[4,5] as to whether or not the need for the B vitamins is also increased when alcohol is oxidized. However, the excessive use of alcohol does tend to deplete the B-vitamin content of the body in heavy drinkers, since they rarely eat when drinking. Polyneuritis, alcoholic pellagra, and some other nutritional diseases frequently occur among alcoholics.

Furthermore, the intake of vitamins and other food essentials is decreased in several other ways by heavy drinking. Vitamin-deficient alcohol takes the place of foods better supplied with them. Alcohol irritates the stomach lining, which may lead to a reduction in the amount of food consumed. It may cause certain structural changes in the digestive tract that will interfere with the absorption and utilization of the vitamins.

Some alcoholics suffer from a liver disease known as cirrhosis. It is believed that alcohol is not itself the direct cause of this disease, since it also occurs in individuals who do not use alcohol. However, the prolonged use of alcohol may lead to a fatty liver, and this in turn, it is believed, contributes to the development of cirrhosis. A fatty heart may result from the steady use of alcohol. Such an ailment interferes with the normal functioning of the heart muscle.

From the foregoing discussion, it is apparent that alcohol, although it does supply some energy, also produces too many harmful effects to be classified as a food in the ordinary sense that meat, milk, bread, fruits, and vegetables are classified. At the same time it should be stated that many of the physical conditions ascribed to the use of alcohol are no doubt due to the malnourishment which frequently accompanies excessive drinking.

Alcohol is a depressant, or narcotic, and not a stimulant, as is commonly believed. It slows the reaction time so that, for example, an automobile driver takes longer to react to signals and danger.

Some alcoholic beverages, such as beer and ale, are now known

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[4] "The Etiology of 'Alcoholic' Polyneuropathy," *Nutrition Reviews*, Vol. 1, March, 1943, pp. 148–151.

[5] "Alcohol and the Thiamine Requirement," *Nutrition Reviews*, Vol. 3, December, 1945, pp. 356–357.

to contain fair amounts of riboflavin, niacin, and thiamine. This is not the case with wines and strong drinks, such as whisky, gin, and brandy. Table 11 on page 352 gives the composition of various alcoholic beverages.

In conclusion, it should be stressed that those who insist on using alcohol should reduce its harmful effects by regularly eating well-balanced diets. The adverse effects of intemperance on emotional control, efficiency, clear thinking, safety, and social behavior are other problems which should be the concern of the American public. But this book is limited to the subject of nutrition.

For Review

1. What is the difference between hunger and appetite?
2. What are the functions of water in the body?
3. What are the salt needs of the body?
4. Discuss diet in relation to the health of the teeth.
5. What is the relation of emotions to appetite and digestion?
6. What methods are recommended for preventing constipation?
7. Name some foods which most frequently cause allergies.
8. What are the effects of caffeine on the body?
9. Discuss alcohol in relation to nutrition.

For Personal Application

1. Check your family medicine cabinet to see what laxatives and cathartics it may contain. Are they wisely used?
2. Make a list of any foods to which you and members of your family are allergic.
3. To what extent are you meeting the suggestions outlined in this chapter for the care of your teeth? In what ways, if any, are you negligent?
4. Find out from your city water department what information, if any, is available on the fluorine content of the city water supply.

14

NORMAL BODY WEIGHT MAKES FOR HEALTH

> The obese person's weight can be reduced by forcing him to burn his own body fat. This is accomplished by curtailing the intake of food, and, through exercise, by increasing its utilization. Both should be done judiciously and with due regard for physiologic laws.
>
> JAMES S. McLESTER, M.D.[1]

In order to have normal weight, a person must have a proper balance between the amount of food consumed and the amount of energy expended. The various factors which pertain to proper balance of food consumed and food utilized have already been discussed. In this chapter some of these points are summarized and stressed, so far as their relationship to body weight is concerned.

There are several reasons why normal weight is desirable for each and every one of us. First of all, normal weight is one sign

[1] From James S. McLester, *Nutrition and Diet in Health and Disease*, W. B. Saunders Company, Philadelphia, 1943. Dr. McLester is Professor of Medicine, University of Alabama.

of good health; overweight and underweight are just as much signs of malnutrition as are scurvy, night blindness, tooth decay, and anemia. Normal weight makes one less prone to disease and contributes to longer life. Individuals with normal weight can carry on their regular activities more efficiently. Also, a person with normal weight makes a better personal appearance than a person who is fat, stout, obese, thin, or scrawny.

The fact that people of normal weight live longer than do those who are too fat is undoubtedly the most convincing proof that can be presented in favor of normal weight.

In the past, young people were encouraged to be overweight to a moderate degree in order to lessen the possibility of getting tuberculosis and pneumonia, to which diseases underweight young people were more susceptible. But since these diseases have now been brought under better control, this is no longer a reason for encouraging overweight among young people. Any advantage there may be to a young person in being overweight is frequently offset by the disadvantage of having formed a habit of overeating – a difficult habit to break in middle age when overweight is not desirable.

Of course a moderate store of fat is desirable. Fat protects muscles from bruises. It serves as a cushion for many of the body organs. Fat protects the body from rapid changes in the outside temperature by serving as an insulator and thereby aiding in the conservation of body heat. It serves as a reserve supply of energy.

There are obviously two phases to this problem of maintaining a desirable weight – namely, gaining and reducing weight. The basic facts for understanding these problems are the same, but those related to losing pounds need to be reversed in application when applied to gaining pounds. However, there is one important difference between the two phases: *It is always possible to lose weight, but it is not always possible to gain weight.* The difference between the two is somewhat the same as the matter of reducing or increasing the amount of heat in a home in the winter. Ordinarily it is possible to reduce the temperature of a house when it is too high; but it is not always possible to raise the temperature sufficiently when the house is too cold.

What Is Normal Weight?

A way of determining approximately whether or not you are too far from your normal or ideal weight is by knowing what is considered definitely overweight or definitely underweight. Anyone who exceeds by 20 percent the figure shown for him in the weight tables is definitely overweight. Anyone who is below the weight-table figures by 10 percent or more is probably underweight. Individuals who are definitely overweight or underweight need medical attention. In fact, if you are in either group, you should not attempt any treatment, by diet or other methods, without first getting your physician's advice on the matter.

Ideal weights for children and youth. For children and youth, weight is considered, along with height, as a visible sign of growth. Growth is subject to many influences, some of which are not yet clearly understood. One factor definitely known to interfere with growth is disease. *All healthy children and young animals grow.* So, *if a child stops growing, something is wrong.* Heredity influences growth and body build. The action of the hormones secreted by the various endocrine glands also has great effect on growth.

Other factors that affect body weight and height are seasons of the year, exercise and work, fatigue and rest, and nutrition. Inadequate nutrition interferes with optimal growth, whether it is due to faulty or insufficient food intake or whether there is some physical, emotional, or social condition which is interfering with the normal assimilation of food.

In most cases, wide variations in the height-weight ratio are due to skeletal differences. In instances where children and youth appear to be too fat, diet may be an important controllable factor, but sometimes glandular disturbances may be at fault. In other cases, individual development may be slow as compared with that of others of the same age. In other words, a moderate deviation from the average weight for height and age may be perfectly normal for a particular child or youth.

The average weight and height is given for girls from five to eighteen years in Table 21, page 370, and for boys from five to nineteen years in Table 22, page 371.

Some parents still believe incorrectly that marked overweight in children and youth is an indication of health. Actually, such overweight may be a psychological hazard to a child or youth who is embarrassed by being different from others of his own age. It also shows that he exercises little control over his food habits in this respect.

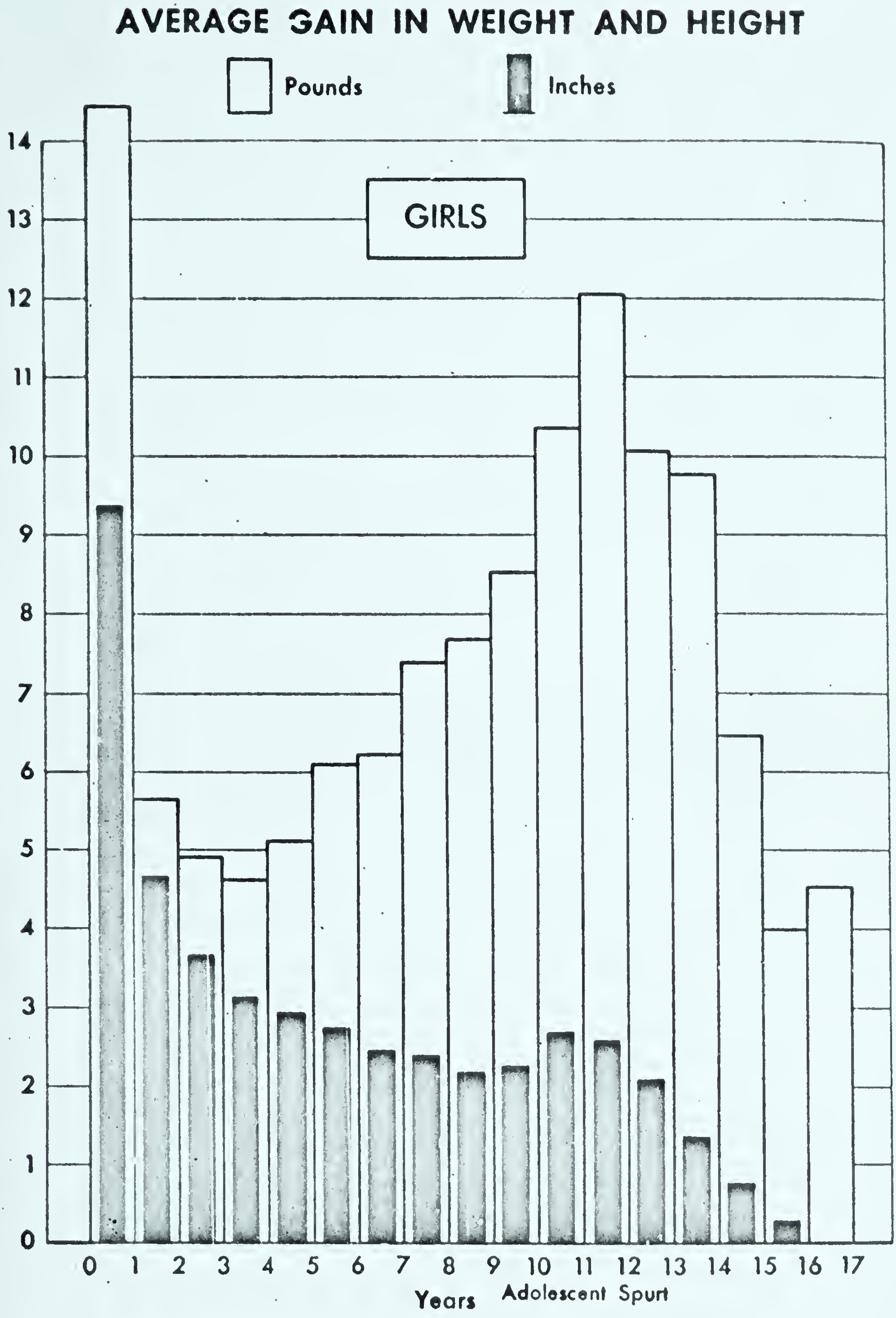
Ideal weights for women. Studies made of average weights among women show sizable increases with advancing age. Thus, between the ages thirty and fifty the average weights for short women increase by 13 to 14 pounds, or more than 10 percent, and those for tall women by 15 pounds or more. Such increases are neither necessary nor desirable. They largely reflect the effect of persisting in the habit of consuming the same amount of food while physical activity decreases.

For adults, irrespective of age, the most favorable weights for health and longevity, according to the Metropolitan Life Insurance Company, are probably close to the averages observed at ages twenty-five to thirty. However, a table of best or "ideal" weights must take into account the variations in the body structure. This is done in Table 23, page 372, which gives the range of "ideal" weights for women past twenty-five for three separate groups of build—slight, medium, and heavy.

It has been estimated that out of 100 adult women, 50 have normal weight, 22 are too thin, and 28 are oversize. It is well for a girl to ask herself which group she is in at present and which group she is likely to be in when a young adult and when over thirty.

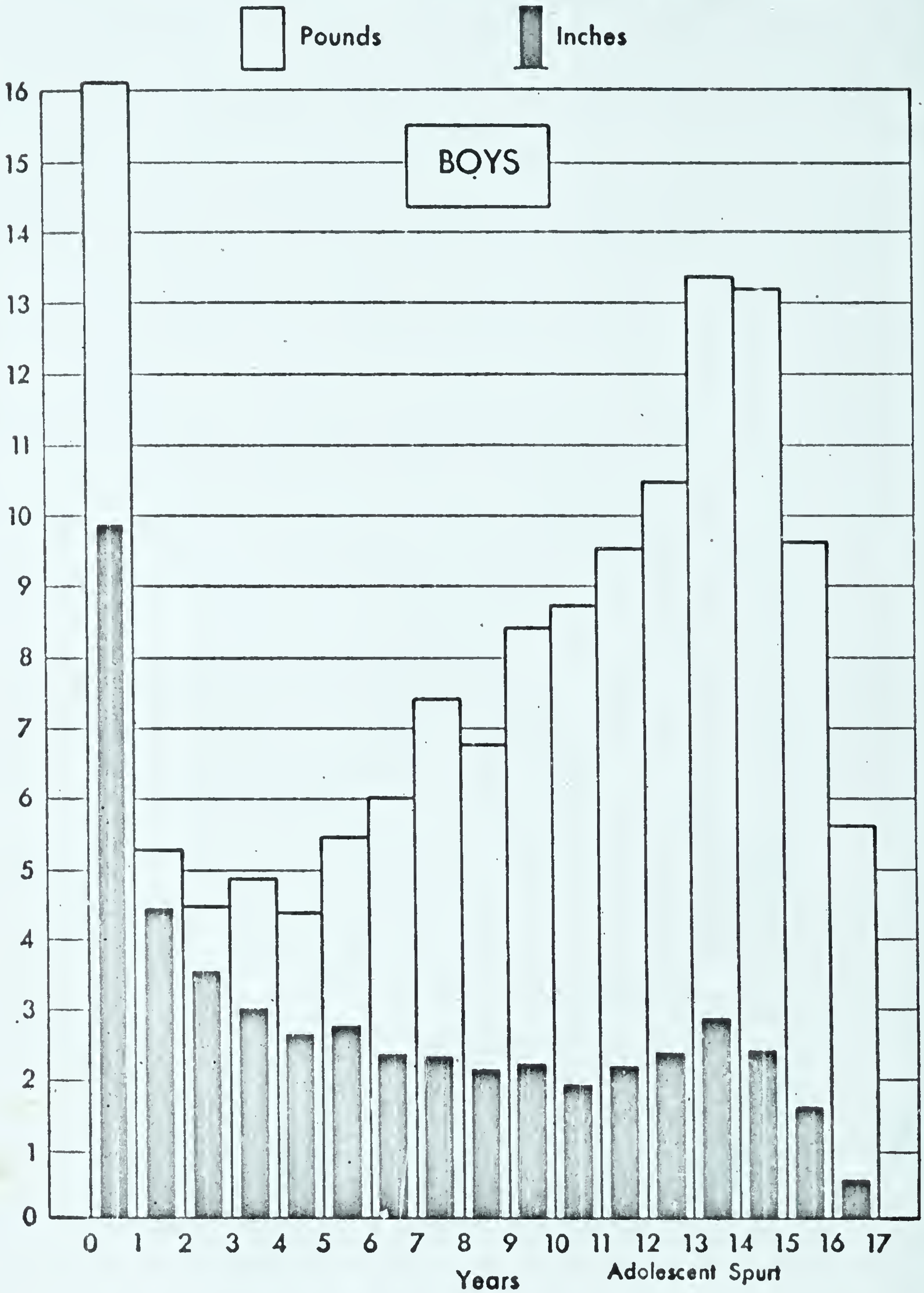
Ideal weights for men. Table 24, on page 373, gives the "ideal" weights for men. Actually, there is no single set of best weights for all men of a given height. Many physical characteristics—the type of skeletal structure, breadth of shoulders, length of trunk in relation to total height, musculature, and other factors—naturally result in variations in body weight. These factors are taken into account in the table, which gives a range of "ideal" weights for slight-, medium-, and heavy-built people.

The table makes no distinction in age but applies to all men twenty-five years or older. Weight tables previously were based



GIRLS have a sudden spurt in growth between the ages of ten and twelve. Their rate of growth then decreases.

AVERAGE GAIN IN WEIGHT AND HEIGHT



Courtesy Metropolitan Life Insurance Co.

BOYS, however, are about thirteen before they begin their rapid growth. This increase in the rate of growth continues until they are fifteen.

upon average weights and showed a progressive increase with age. Thus, even for men of medium height, the averages rose 12 pounds between the ages of twenty-five and fifty. Statistical investigation has shown such increases to be undesirable from the standpoint of health and longevity.

If You Are Overweight

Probably the most frequently discussed topic of nutrition is that of overweight, but talking about it is as far as many persons get with this problem. An individual who is considered to be overweight has a body weight above normal but not necessarily an excessive amount of body fat. An individual who is not only overweight but who has an excessive amount of fat deposited in the form of an inert storage tissue is called obese.

Stout people have certain disadvantages. They are not so comfortable as those with normal weight. They are not so active and tire more readily, and they are not so efficient physically as they might be if they did not have extra weight to carry around. Unfortunately, many people—girls and women in particular—do not become concerned about their overweight until their vanity is affected; they eventually discover that they just don't look as well as they might and that they cannot wear the styles designed for the average slender figure. If you are in this group, you will want to know the reasons for your overweight and the facts about getting rid of your condition.

Causes of overweight. If you have excess fat, it is because your diet regularly supplies more energy—that is, more calories—than is normally needed for your body functions and your physical activity. Constitutional factors—such as a hereditary tendency to overweight or underweight—may affect the weight of some people and need to be taken into consideration in gaining or losing. Some people are stout because they are able to put their calories to more economical use, and so they tend to store the surplus energy faster.

Some individuals are overweight because of glandular disturbances. However, their number is relatively small. Conse-

quently, one must conclude that most overweight individuals are so because of an improper balance between calories consumed in the diet and calories burned up by the body. Even if the endocrine glands are not functioning normally, that alone will not make you fat. Fat can come only from eating an excess of foods over that which is needed.

Many physicians are stressing the importance of emotional tension in cases of overeating. That is, some people are driven to food as others are driven to drink. The driving force may be worry, frustration, fear, or a feeling of insecurity. When the individual has a natural tendency to overeat, these tensions accentuate this desire for food. An understanding psychiatrist may be needed to help the fat person understand the nature of his psychological problems.

One physician has reported that out of 500 obese patients, 370 had stated that they either ate large meals or ate more frequently when they were nervous or worried. Another 95 said that they ate more when they were idle, bored, or tired. The other patients said that they just enjoyed food.

When is it dangerous? When you accumulate 10 extra pounds of fat, it is more than enough. But when the surplus goes up to 40 and 50 pounds, you have definitely affected your appearance and you have put a real strain on your vital organs. Remember that fat, body fat—those extra rolls around your waistline or under your chin—is stored calories of heat and energy. The thin person does not have enough, while the stout person has too much.

One pound of adipose tissue—body fat—is about four-fifths actual fat and about one-fifth water. Therefore, the number of calories in a pound of adipose tissue is only about four-fifths as much as in a pound of pure animal fat, such as lard, or about 3,300 calories.[2]

A person who is 50 pounds overweight has about 165,000

[2] This figure is arrived at in the following way: 1 pound equals 453.59 grams. One gram of 100 percent pure animal fat, such as lard, contains 9 calories. One pound of pure fat, therefore, contains 4,082 calories. Fat tissue is estimated to contain 20 percent water. Therefore, 1 pound of body fat (tissue) contains 80 percent of 4,082, or about 3,266 calories. We shall use the round figure of 3,300 calories.

Courtesy "Life"

Students of different sizes were weighed under water in a test made at the University of Minnesota to find out the amount of their fat, as compared to their muscles, bones, and organs. The thin students weighed more than the heavy ones, showing that their specific gravity was high and the amount of fat low.

calories stored in the form of excess body fat. This number of calories is equal to the number normally needed in a 2- to 3-month period for individuals in sedentary work.

If you are very much overweight, it points strongly at you in two ways. You either lack will power so far as your eating habits are concerned, or you are very ignorant about the relationship of food to your body weight. Both faults are correctible in the case of most people.

A University of Minnesota physiologist, Dr. Ancel Keys, is carrying out experiments to find out how fat fat people are.[3] This study is being done by dunking students in a tank of water. When the weight lost under water is compared with what the student weighs in the air, the ratio between them indicates how heavy the subject's body is in relation to its volume. Since fatty tissue is lighter than bone and muscle, a man who is really fat will have relatively little weight when immersed in water.

The principle involved is an ancient one in physics. An object floating in water displaces a weight of water equal to its own weight, and the same object submerged in water displaces a vol-

[3] "How Fat Is a Fat Man?" *Life*, October, 6, 1947, pp. 88, 91–92.

ume equal to its own volume. The long-range work of Dr. Keys's laboratory is directed toward one of the biggest problems which medicine faces—diseases of the heart and blood vessels. By accurately weighing the fat of hundreds of people, he hopes to clarify the relationship between excess fat and such diseases.

What can be done about it? All the methods used in reducing fall under one or the other of two general headings. Either the amount of body-fuel food is reduced or the rate at which food is used is increased. The ideal procedure involves the use of both of these general methods.

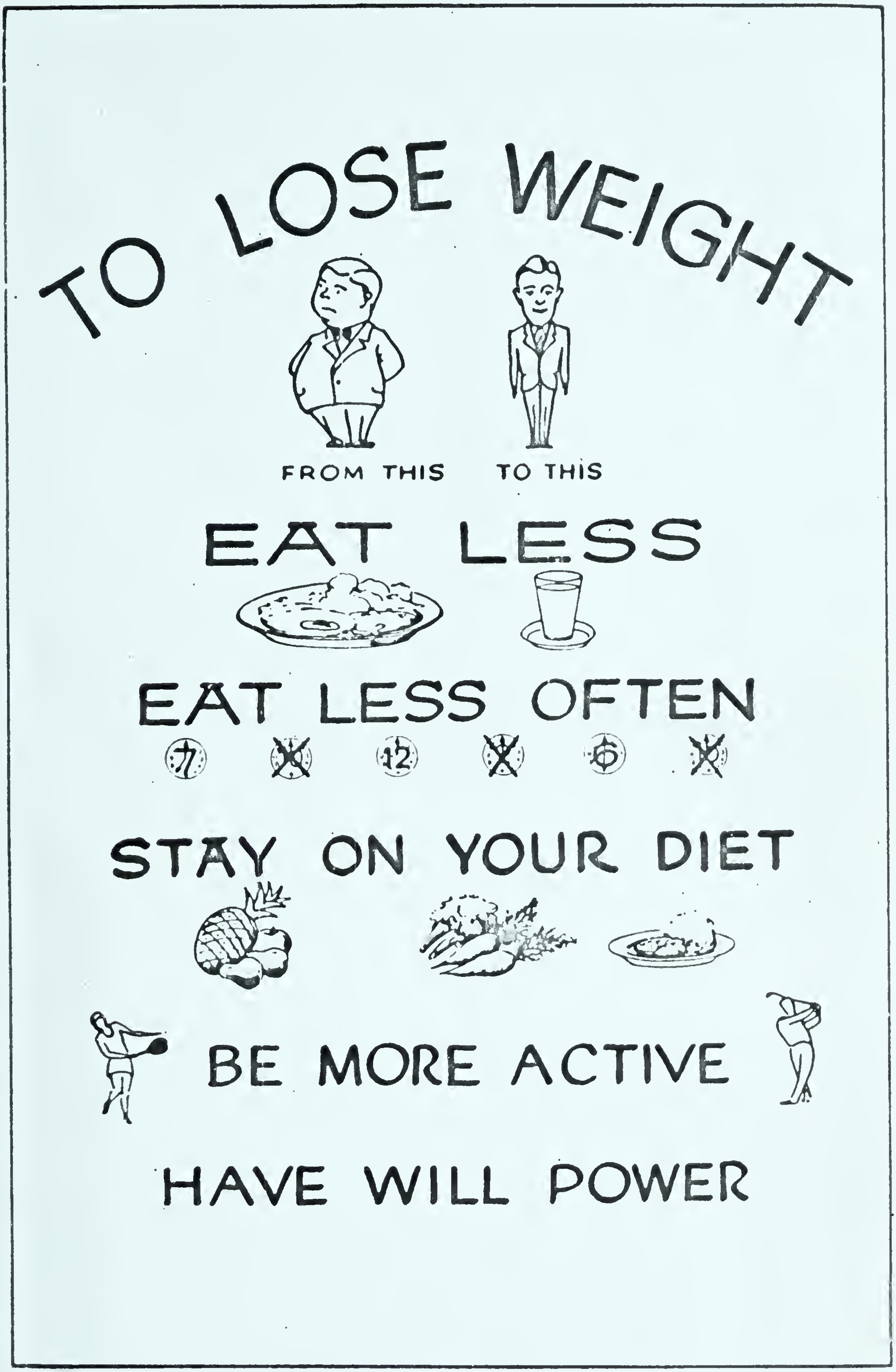
A reducing diet should meet certain requirements. It should consist of foods easily available to the person, and it should meet the individual's needs for those nutrients other than the fuel foods, or calories, given in the Nutrition Yardstick.

Some reducing diets are not safe because they do not supply sufficient protective foods--foods high in protein, vitamins, and minerals. By now it should be clear that, regardless of how many or how few calories are included in the diet, the amount of vitamins, minerals, and proteins must not be reduced below the amounts in the Nutrition Yardstick. Also, it should be remembered that milk is a must, even in reducing diets. Other foods can be left out of the diet more safely.

A second danger concerns itself with the rate at which fat is being lost. Any rate which is greater than 1 pound per week needs to be watched very carefully because the faster the rate, the more difficult it is to plan a diet which is both low in calories and normal in the other nutrients. Also, the body is frequently unable satisfactorily to utilize fat from the body at a rate much faster than that mentioned. Undesirable by-products may result from the incomplete breakdown of the fat molecules.

Any person supposedly on, for example, a 1,000-calorie diet who fails to reduce, is cheating. The reason is apparent when we recall that nearly all adults require at least 1,500 calories a day to maintain weight when at rest. The purpose of a reducing diet will be defeated if you "snitch" and nibble on food, candy, and other delicacies between meals. This point also applies to beverages.

Since some of the many current popular reducing methods, particularly dieting, are often harmful, it is very important to



Courtesy Eastman Kodak Co.

know the right procedures to use. It should be emphasized that, in reducing, the loss of weight is not in itself dangerous, but the method that is used may be. Therefore, a number of methods are discussed with information on their scientific soundness.

Reducing by lowering calorie consumption. A reduction in the number of calories is one of the simplest methods of inducing weight loss. Therefore, the best way to fight fat is to fight appetite—especially an appetite for rich foods. Obesity due to gluttony, or overeating, is treated by changing to a diet which is low in calories. The following example illustrates the theoretical effect of excess calories on one's weight:

If you require only 2,200 calories per day but are eating 3,000, you have a daily excess of 800 calories. Over a period of 1 month, this adds up to 24,000 excess calories above that which you normally need. Excess calories are stored as fat at the rate of about 3,300 calories per pound. The 24,000 calories, therefore, will equal 7.3 pounds of surplus body weight. No doubt this illustration is an extreme case, but it illustrates the point. The moral from this should be: "Count your calories."

That extras and in-between nibbles are common causes of overweight and interfere with attempts to reduce is apparent from the following set of figures which show how many miles you would need to walk to make up for these indiscretions:

WALKING IT OFF*

Food Item	*Miles*
One ice-cream cone	1½–2
One 1-inch square chocolate fudge	1½
Four lime drops	1
One bar milk chocolate	4
One ice cream sundae	5–7
One doughnut	3
One cup buttered popcorn	2½
One piece mince pie	6½
One cup ginger ale	1

* Quindara Oliver Dodge, *Weekly Menu and Nutrition Service*, Associated Industries of Massachusetts, Boston, Vol. 1, 1944, p. 3.

It is not harmful to go on a reducing diet while carrying on regular schoolwork or a job. In fact, it is frequently easier to diet while carrying out the usual routine, because activity helps to keep the mind off the subject of food.

In connection with the matter of lowering the caloric consumption or changing the diet for the purpose of reducing, we might again point out that our appetites are too dependent upon customs and cultivated tastes rather than upon nutritional values. But for those who actually wish to lose pounds, the rules are quite simple: See to it that you eat the daily recommended amounts of all nutrients, except calories from starches, sugars, and fats. From what you have already learned in this book, it should not be too difficult for you to plan your own diet accordingly.

Exercise. Several methods of reducing are based on the idea of using body fat, as well as food, as a source of energy. They all increase the body's rate of metabolism and thereby consume more calories—but from body fat instead of from food directly. The most important of these is exercise.

Exercise can be a means of reducing, along with a control on our consumption of energy foods, for people who are slightly overweight or who wish to reduce slowly. It is the normal method of burning up food and excess fat. At the same time it contributes to better health in general. Refer to Chapter 4 on calorie needs to see the important contribution that exercise can make toward using up extra calories.

The amounts of various physical activities needed to lose 1 pound of weight—3,300 calories—are here listed. These figures are for an average man who weighs 154 pounds. Lighter people would need to work proportionately longer to use up an equal amount of energy. The 1-pound weight loss can occur only if the 3,300 calories come from body fat and not from food. The numbers in parentheses in the following list represent the number of calories used per hour for various activities:

Rest in bed for 43 hours (77)
Sit for 33 hours (100)
Stand for 31 hours (105)
Sing for 27 hours (122)

Physical activity can be a means of reducing, but it is an ineffective method compared with dieting. For example, a man weighing 154 pounds would have to engage in the following activities for the time indicated in order to lose one pound:

Courtesy National Council YMCA

Swimming: 6½ hours

Courtesy U.S. Dept. of Agriculture

Splitting wood: 7 hours

Courtesy Oregon State College

Playing volley ball: 11 hours

Courtesy American Youth Hostels, Inc.

Riding a bicycle: 5 miles an hour for 25 miles

Wash dishes or iron clothes for 23 hours (144)
Play touch football for 17.5 hours (188)
Walk slowly at 2.6 miles per hour for 43 miles (200)
Work at carpentry for 14 hours (240)
March with rifle and heavy pack for 7.2 miles (455)
Walk very fast at 5.3 miles per hour for 27 miles (650)
Ride a bicycle at 5.2 miles per hour for 25 miles (679)
Run at 12 miles per hour for 20 miles (2,043)

Similar data for other types of activities can be worked out from the information in Table 4 on page 67. It is apparent from this list that if exercise is to be a means of reducing it must be sufficiently regular and strenuous to be of value in taking off weight or in preventing it from being added. However, for many people who are overweight, to exercise strenuously is not convenient or wise, and so the reduction of calories in the diet becomes the logical and sensible procedure to use. Light exercise is not of much help in removing excess poundage, but it has other values—social, health, and recreational. For most individuals, the best plan for reducing is to combine exercise with dieting.

Paradoxically, some individuals may gain in weight when they begin to exercise. This is because exercise frequently improves health and permits a better utilization of the food consumed or it induces a better appetite so that more food is eaten. Many women undo their efforts at reducing through exercise by eating more foods. An extra slice of bread will easily supply the additional calories used up in a ½ hour of moderate exercise. Also note, on page 239, the number of miles you will need to walk to make up for various items of food. No wonder many people become discouraged with exercise as a means of losing that extra tire or roll around the waist and therefore turn to the many less scientific and more spurious methods of reducing.

Doubtful methods of reducing. The remaining methods are either of doubtful benefit or are actually harmful to the one using them.

Massage is a form of passive exercise that does not require the muscles to use up energy in the process. It does aid in the

maintenance of muscle and skin tonicity and therefore does use up some calories. But the value of massage as a weight-reducer is very much overestimated.

Salts in the bath water are of no value directly in reducing. The sweating induced by a warm or hot bath may result in a temporary loss of weight, as already discussed.

Steam baths and other forms of heat applications supposedly reduce body weight. However, it is unreasonable to expect heat to do the same thing that cold does—namely, increase the rate of metabolism. Heat applied to the body induces perspiration and therefore a loss of water and salt. But this loss is only temporary and does not concern itself with actual body fat. You undoubtedly have heard it said that football players have been known to lose several pounds of weight during a game. If this loss actually took place, it was not fat that disappeared but rather water lost through perspiration. This type of weight loss is ordinarily made up within 24 hours.

Wearing girdles and straps to remove surplus fat is of negligible value. In the case of the abdominal girdle, the posture is undoubtedly improved, and so there seems to be a reduction in the individual's girth.

The use of thyroxin from the thyroid gland for reducing weight is scientifically correct in principle, since this hormone speeds up the rate of metabolism. But it is not to be used except under a doctor's recommendation. Many of the advertised fat-reducing nostrums on the market today embody this principle. The advertising on the package frequently states "Eat all you want to," the implication being that the excess calories will be burned up through the use of this patent medicine. A number of newer drugs on the market act in the same way as thyroxin, but all should be used only on a physician's advice.

Laxatives taken internally may aid in reducing weight by their purging action. When a laxative is taken, water is eliminated in quantity from the body, and consequently there is a temporary loss in weight—similar to sweating losses; but the loss is restored when sufficient water has been consumed. This method, consequently, does not result in true loss of weight, for no body fat is

burned up. Furthermore, this procedure may interfere with the absorption and digestion of food in an undesirable way.

Insufficient sleep or overwork will reduce weight, but it is dangerous to one's health.

If You Are Underweight

Unfortunately, less can be done to correct underweight than overweight. People who are underweight have one advantage over the overweight individuals in that they need not curb their appetites.

Individuals who are underweight usually fall into one of two groups: (1) those who are underweight even when their diet is apparently adequate and (2) those who are underweight because they have a poor appetite or who experience a feeling of being filled up even after eating a small amount of food.

A complete physical examination is desirable to discover other possible causes of one's underweight.

If you are in the first group and are otherwise in good health as determined by your physician, perhaps there is not much that can be done about increasing your weight. However, if you are in the second group, we suggest the following methods for increasing your weight:

1. Learn which foods are high in energy value, and include these in your diet to a greater extent than you have been doing. Remember that if you need, for example, 2,200 calories per day for your age, sex, weight, and activity but are eating only that same amount or less, you cannot possibly gain in weight. Now, if you increase your calorie consumption to 2,600, an increase of 400, you should theoretically gain 3.6 pounds in 1 month.

2. Limit the amount of fluid, such as soups, coffee, and water, which you consume at mealtime. These liquids tend to fill your stomach before you have had an opportunity to eat sufficient amounts of fattening foods.

3. Masticate your food well so that your digestive system will be better able to utilize it.

Courtesy Eastman Kodak Co.

4. Learn to eat a hearty breakfast which contains at least 25 percent of your day's needs of calories and protective foods.

5. Copy the overweight person by eating more often. Eat several times a day, in addition to the regular three meals. This procedure is especially recommended if you are one whose stomach fills up too soon.

6. Watch your general hygiene to be sure that no other factors are keeping your weight down. Nervous tension, hurry, insufficient sleep, too much smoking, and lack of exercise may be the cause of your underweight. Remember that those methods of hygiene which make for better health are also likely to help you to reach and maintain your normal weight.

7. Finally, be sure that your daily diet fully meets the Nutrition Yardstick in all nutrients. Remember that the appetite-stimulating vitamin—thiamine—must be increased, along with niacin, as you step up your carbohydrate calories. The assimilation of nutrients in the body is aided by niacin.

Many people continue to be "skinny" because they think it is hereditary or glandular in origin and that there is nothing they can do about it. People who are thin but otherwise in good health should be able to put on added weight if they follow the seven recommendations suggested. The underweight person should increase the total amount of food consumed until a store of surplus fat has been built up to give him a weight which is normal for his age and height.

For Review

1. When is a person considered to be overweight? Underweight?
2. What objections are there to being overweight? Underweight?
3. How many extra calories must you burn up to lose 1 pound of body weight?
4. Give some pointers on reducing through dieting.
5. What dangers are to be warned against in reducing through dieting?
6. Ordinarily, is it easier to reduce or gain weight? Why?
7. Discuss exercise as a means of reducing.
8. Is massage of any value as a means of losing weight?

9. List several unsound methods of reducing.
10. List the seven recommendations for gaining weight.
11. If all or most of the members of a certain family are overweight, what are the probable reasons for this?
12. Name several foods high in calories which also contribute essential nutrients.

For Personal Application

1. Compare your answers to the following two sets of questions: (*a*) How much do I weigh? How many calories do I consume daily on the average? (*b*) How much should I weigh? How many calories should I consume daily to maintain correct weight?
2. Plan a day's balanced diet which contains (*a*) 500 and (*b*) 1,000 calories less than you normally need, assuming that you wish to lose weight.
3. Similarly, plan a day's diet which contains (*a*) 500 and (*b*) 1,000 calories more than you normally need, assuming that you wish to gain weight.
4. If you are actually attempting to reduce or to gain weight, keep a progress record by weighing yourself weekly at the same time of the day and in the same amount of clothing.
5. If you desire to lose 15 pounds of surplus fat in 90 days, how many calories less should you eat than the required amount estimated in problem 1 (*b*)?
6. Assuming that insufficient calories in your diet was the only reason why you did not weigh as much as you should, how many pounds would you gain in 2 months if you actually ate 300 calories daily in excess of your normal needs?
7. Observe the eating habits of some individual who is overweight. Do you think that the amount of food he eats contributes to his overweight? Or are there other apparent reasons? Do the same for someone who is underweight. What conclusions can you draw?
8. How many calories would be eliminated from your typical weekly diet if you discontinued using sugar, candy, and soft drinks?

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FOOD PRODUCTION AND CONSERVATION CONTRIBUTE TO NUTRITION

> Theoretically, in a land of free enterprise the responsibility for preserving the resources of a nation should rest upon individual initiative, but this can only be counted upon when there is general public understanding of a situation and of the means of dealing with it. This knowledge is lacking in the urban population which comprises considerably more than half of our people. In the rural population there is, fortunately, a growing consciousness that the productivity of our land is threatened, together with an increasing knowledge of the steps that must be taken to avert this peril.
>
> FAIRFIELD OSBORN[1]

The program of food conservation, or reducing food waste, covers a wide range of situations, beginning at the farm and ending with the individual at the family table. Conservation as related to food involves planting, harvesting, storing, transporting, processing, wholesaling, retailing, preparing, serving, and eating. It

[1] From "The Country That Can Feed the World," *The Atlantic*, April, 1948. Mr. Osborn is also author of *Our Plundered Planet*.

concerns farmers and people who plan meals and handle food in restaurants, schools, hotels, hospitals, and other institutions, as well as families and individuals. Some of the means of increasing and conserving the quantity and the quality of our nation's food production and some of the problems of reducing waste and conserving food value—mainly as these relate to you directly and personally and to your own family—are considered in this chapter.

By increasing our food production above our own national requirements and by reducing our food waste and losses, it is possible for the United States to share its food supply with needy countries. In light of the great food needs of the world, we must avoid showing unconcern by wasteful food habits. We should keep in mind that starvation in other countries contributes to unrest and war and that adequate food contributes to stability and peace.

Increasing National Food Production

The farmers of our country have responded well in recent years in the matter of increasing food production, when the need for additional food has been so great. The significance attached to food as an implement of war as well as of peace has served to stress its importance. When we realize that 70 percent of the business of the world is estimated to be in the production, transportation, and sale of food, it becomes obvious that this subject deserves our attention.

Scientific farming, an aid to production. The first way food production has been increased is by the increase in acreage being farmed; but many important advances in scientific and mechanical fields have also contributed to the larger total output of food:

1. Because of the increasing knowledge of nutrient needs of plants and animals, there has been an increased yield per acre of grains, fruits, and vegetables; increased production of meat on food animals; and an increase in the number of eggs from hens and the amount of milk from dairy cows. Through the study of soils and by the increased use of fertilizers, such as lime and

Courtesy U.S. Dept. of Agriculture

By applying a liquid indicator to samples of soil, soil surveyors determine the degree of acidity of the soil. This information is helpful in deciding what types of plants will grow best in any particular soil and what kind of fertilizers the soil needs.

phosphates, plant yields have been improved considerably. Higher quality plant food has produced better animals.

2. Research in eugenics—the science of producing better offspring—has contributed to new and improved varieties of plants and breeds of animals.

3. Improved farm machinery has made for larger crops and increased the total yield per farmer.

4. The discovery of new and economical insecticides and weed killers has helped to increase the yield of plant life. Also, by controlling the insects on animals, we have had greater production of meat, milk, and eggs.

5. Hydroponics—or soil-less gardening—is among the latest of scientific applications of knowledge about fertilizers and mineral needs of plants. Hydroponics is based on the idea of supplying the necessary minerals to plant roots in water solution only, without relying on any soil.

The variety of agricultural research mentioned is being conducted by individual farmers, by each of the states, and by the federal government. As new needs of farmers and consumers become apparent, research will be undertaken to meet them. Progress in plant breeding will become increasingly significant

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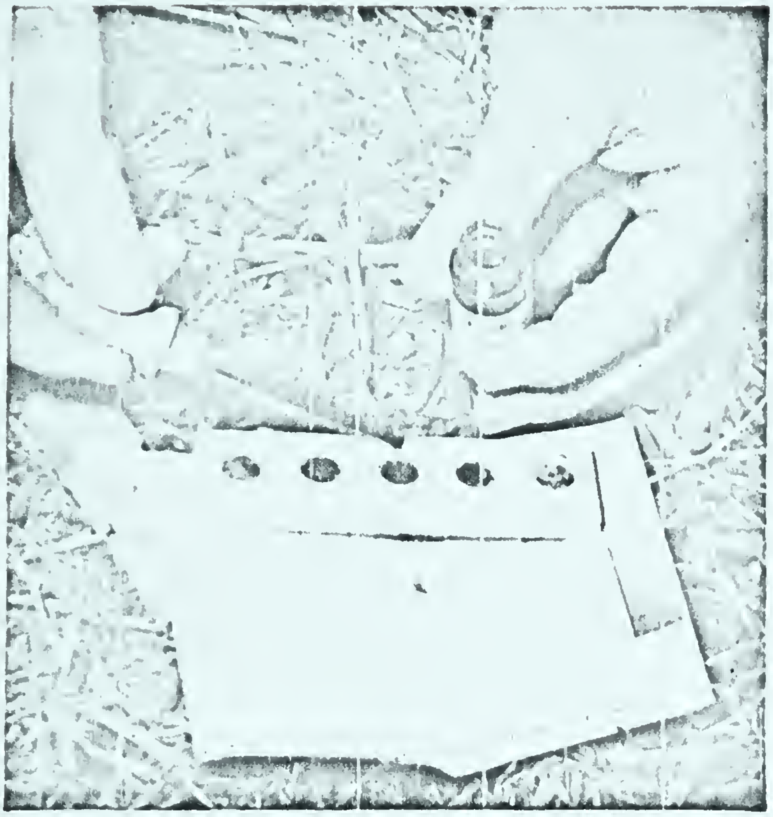

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gives much greater food value than does a herd of beef animals which yields, in the form of beef, less than 4 percent of the value of food consumed.

The significance of home gardens. A home garden can contribute very definitely to a family's food needs. The aggregate of all food so produced in the entire nation is quite significant. Usually, the vegetables and fruits raised in a home garden are consumed in addition to those which the family ordinarily buys or is accustomed to consuming.

Such increased consumption of vegetables and fruits can contribute very materially to an increase in one's nutritional status and general health. There are, of course, other values to be gained from having a home garden, such as exercise and recreation when gardening is looked upon as a hobby.

By carefully studying the soil and by applying the right kind of fertilizers, families with home gardens can have fresh vegetables on the family table for several months of the year. Also, when the surplus food is canned, they can have the benefit of their garden products throughout the year.

Checking Our Depleted Soil

In spite of the important advances in food production, a serious negative factor has been developing during the 300 years since the white man first started to till the soil in what is now the United States. It concerns the depletion of the soil and the accompanying loss in the fertility of our land. This is a matter of national concern.

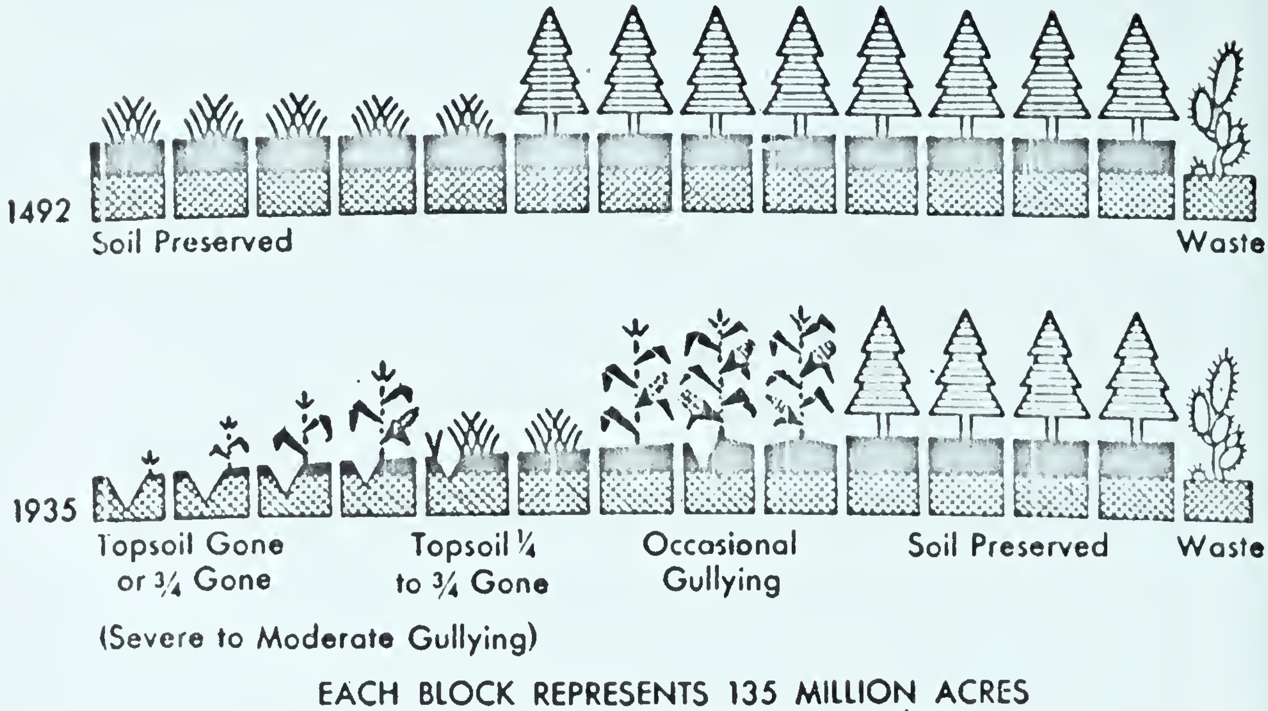
Our starving farm land. The virgin soil of our country contained valuable mineral elements needed for the growth of plants and needed by man from the plant foods he consumes. But during cultivation of the soil, conditions have been created which have reduced the amount of the minerals in the soil. The worst of these conditions is soil erosion.

When sod is cut by means of the plow, the land is laid bare for erosion. Wind and water then sweep away the loose topsoil unless steps are taken to protect it. Water erosion occurs mostly on slop-

Courtesy U.S. Soil Conservation Service

When eroded land, such as that shown in the top picture, is planted with a cover crop (*bottom*), the topsoil is protected from being blown away by wind or washed away by water.

Extent of Erosion in the United States



Courtesy U.S. Soil Conservation Service

Note that since the founding of our country the amount of cultivatable soil has diminished considerably. How can such a trend be checked?

ing land. When there is little or no vegetation to hold the rain water, the water runs off, and every drop of water that runs off carries with it some soil in solution and some of the valuable minerals which gave the land its value. Wind erosion, which occurs on both level and sloping land, results in dust storms which carry away topsoil or cover it with debris. Thousands of acres of land have been ruined by wind erosion, and many crops that are planted and harvested in such soil lack the necessary minerals.

Besides the serious harm from erosion, there is the drain on the mineral content of the soil from planting and recropping unless steps are taken to replace the minerals used by the plants. Consequently, even without erosion, soil can be depleted so that it is no longer able to produce crops to the same extent as formerly. But such lowering of the productivity of the soil, with the resulting lessened plant growth, further exposes the soil to wind and water erosion.

The extent of soil depletion. When the white man came to North America, the land was covered with an average of 9 inches of productive topsoil. Since that time about one-third of that top-

soil has been allowed to be lost through destructive processes. Each acre of fertile soil which is carried off to the sea or which is cropped and recropped without returning to it any of the mineral elements used by plants means to consumers today less food and food of lower quality.

It is estimated by authorities that, within the past 100 years, our faulty farming methods have resulted in the destruction of 20 percent of our land values. In 1935, when the Soil Conservation Act was passed, the United States government made a survey of the land of the whole country—1,900 million acres. This survey showed that, of the original soil

- 3 percent, or 57 million acres, was completely destroyed.
- 12 percent, or 225 million acres, was three-fourths destroyed.
- 41 percent, or 775 million acres, was one-fourth to three-fourths destroyed.
- 37 percent, or 700 million acres, was less than one-fourth destroyed.
- 7 percent, or 143 million acres, consisted of mountains, canyons, bad lands, etc.

According to these figures, if we were to take all our unfit land out of cultivation today and use our remaining farm land, we would have little more than 2½ acres per capita under cultivation. Two and a half acres per capita is the minimum amount of land that is required to support our population adequately.

The relationship of minerals to crops, farm animals, and people. Scientists have traced an unbroken linkage between mineral-deficient soils, deficient crops, and malnourished farm animals and people.

Plants exhibit hunger signs, when they lack sufficient minerals, which are as familiar to the plant physiologist as are the symptoms of human deficiency diseases.

Animals also show unmistakable signs of mineral hunger when the food is inadequate. One group of agriculturists are studying, for example, the deficiencies of known minerals and vitamins in the cow's diet. They are learning how to cure tongue lollers, cement and wood chewers, hay-ball rollers, and other bovine victims of eccentricity due to dietary deficiency.

Courtesy U.S. Dept. of Agriculture

Plants need food just as people do. When the nutrients have been depleted in soil, plants cannot grow in it unless it is supplied with food in the form of fertilizers.

Modern and improved breeds of animals, almost without exception, have been developed in mineral-rich areas. For example, the history of American race horses shows that horses with exceptional records were raised in regions rich in limestone. In the same way, the best plant crops grow in soils high in mineral content. It has been demonstrated many times that the same crop from the same seed and method of cultivation, but grown on better soils, will contain more minerals and vitamins.

Remarkable work has been done in treating sick soils through the application of the right kind of fertilizers. Improved yield and quantity are obtained by adding natural fertilizers and commercial fertilizers rich in nitrogen, lime, and phosphates. By putting back into the soils the minerals of which foods are made, it has been possible to raise better potatoes in Maine, better grapes in California, better oranges in Florida, and better field crops in other states.

More recent experiments with other minerals have given interesting results. For example, a little boron added to the soil around apple trees has apparently doubled the vitamin-A content of the fruit. Tomatoes with triple the vitamin-C content resulted after a small amount of manganese was added to certain

fields. In Florida the iron content of milk has been increased from 21 to 55 parts per million through proper fertilizing of the soils upon which the cows graze.

A healthy plant, grown in soil which is properly balanced, is able to resist insect pests and other diseases much better.

The importance of assuring a balanced diet for man by providing the required elements in the soil is just beginning to be recognized by the general public. The condition of our land, and what can be done about it, should be of concern to city people as well as to farmers. City people cannot afford to forget the fact that they are dependent upon farms for most of the food they eat and much of their clothing.

It is the responsibility of each generation to leave the soil as fertile as it was found. For thousands of years this was not done, and as soon as the soil in one locality became depleted, people were forced to move on to newer and better land. But now the whole earth has been settled, and we can no longer run away from ruined soil to find new and better land to deplete.

How soil conservation is undertaken. The U.S. Agricultural Conservation Program has for its aim the building up of a set of farming practices that will lead each farmer to keep in his land a balance of fertility against which he can draw to produce a fine crop without depleting his soil.

Conservation practices vary widely in accordance with the land. Altogether, more than 50 major practices—ranging from contour tillage, terracing, and strip cropping to pasture improvement, water development, and farm-woodland management—are employed in such combinations as are needed in various parts of the country. It is estimated that complete soil-conservation treatment has increased per acre yield by 20 percent at least.

When a field has been planted in contour strips, all running across the slope—with strips of grass, hay, and cultivated crops alternating—the expensive fertilizer stays where it is put. And the irreplaceable soil stays there too. If a dry spell should come, land that has been so planted holds its moisture better. In areas damaged by wind erosion, windbreaks are used.

Courtesy U.S. Soil Conservation Service

Alternating strips of cultivated and close-growing crops, called strip cropping, is one effective method of conserving the soil and water on sloping land that is otherwise likely to become eroded.

In 1945 it was estimated that almost a billion acres of farm land in the United States needed complete soil-conservation treatment and that the basic work of conservation could be done in about 20 years if technical assistance, labor, and machinery were made available.

The program of the Tennessee Valley Authority is an example of a large-scale demonstration in soil conservation. The TVA was established as a regional agency, instructed by Congress to perform specific tasks having to do with the improvement of navigation on the Tennessee River, the control of floodwaters, the protection of the soils of the watershed, and the generation of electric power. The electric power has been used in the production of more concentrated and more efficient plant nutrients or fertilizers. The program has provided the farmers with the opportunity to learn the value of mineral plant nutrients and new soil-restoring patterns of land use by seeing how they work on their own and their neighbors' farms.

Conserving Nutrients by Careful Food Preparation

A number of factors have been discovered by study and research that have a destructive effect on the nutrients of a food. The placing of greater emphasis upon the retaining of nutrients in food preparation and cookery will enable a given amount of food to contribute more value nutritionally.

Factors which destroy food values. The following points summarize the several factors and procedures which affect the retention or the loss of nutrients as previously discussed in this book:[2]

Among minerals. Minerals are soluble in water and are therefore lost from food when the food is soaked or cooked in water. If you should cut open a beet and place it in water, you would see the water become red in color—the pigment in the beet has gone into the water. If soluble minerals and vitamins were equally visible in the cooking water in which they were dissolved, no doubt we would be much more careful about the way we prepare our fruits and vegetables.

Among vitamins. The B vitamins and vitamin C are soluble in water in the same way that minerals are. A loss therefore occurs when vegetables and fruits containing these vitamins are soaked or cooked.

When foods are exposed to the air, they lose their vitamins A and C by oxidation. Oxidation occurs more quickly when plant surfaces are exposed through cutting and peeling. Foods stored for long periods of time, particularly at room temperature, gradually lose these vitamins through oxidation.

Heat hastens the destruction of the vitamins and is especially harmful to vitamin C. Low temperature retards the destruction of vitamins. Overheating, such as making toast dark brown or cutting bread very thin and toasting it—Melba toast—results in greater destruction of thiamine and riboflavin. Vitamins that are sensitive to heat are said to be heat-labile.

Some vegetables and fruits contain enzymes which hasten the oxidation of vitamin C, particularly when they are exposed to

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[2] Compare the vitamin and mineral content of "raw" and "cooked" forms of the same foods, as given in Table 10 in Appendix A.

Pouring vegetable water down the sink is a waste of valuable minerals and vitamins that have been removed from the vegetables during cooking. The water should be eaten with the vegetables or saved for use in gravies and sauces.

Courtesy U.S. Dept. of Agriculture

the air by the cutting of the plant cell walls. If heat is applied quickly at a high temperature to food which is to be cooked, the enzyme will be destroyed and thereby the effect of oxidation on vitamin C is reduced. For this reason, vegetables are scalded before being frozen and stored. These enzymes are also active at room temperatures; therefore, all vegetables except potatoes should be stored in the refrigerator or kept in a cool place.

Riboflavin is destroyed by strong light. Therefore, milk and other foods containing riboflavin should not be exposed to sunlight.

Baking soda is very destructive of thiamine and vitamin C. Soda is often used to retain or make brighter the green color in vegetables. If the vegetables are of high quality and are properly cooked, the green color is retained without the addition of soda. Also, excess soda added to baked goods results in greater loss of thiamine.

Among proteins. Because the amino acids in proteins are destroyed when food is burned, the nutritive value of the food is reduced. For example, when meat is burned its protein value is reduced.

Among fats. Fats and oils are destroyed by very high temperatures. Also, butter becomes rancid when not refrigerated satisfactorily. Rancidity seems to be destructive of vitamin A.

Suggestions for saving nutrients. The following practical suggestions for saving vitamins and minerals are based upon the scientific points just explained:

1. Do not let vegetables soak in water unnecessarily.
2. Cook or bake vegetables in their skins.
3. Keep air—oxygen—away from vitamin-rich foods:
   - *a.* By keeping food covered while it is cooking and by covering food containers.
   - *b.* By not stirring food unnecessarily, since it mixes air with food.
   - *c.* By not cutting up vegetables and fruits until they are to be eaten or cooked.
   - *d.* By serving all foods as quickly as possible after they have been prepared.
   - *e.* By squeezing fruit juices just before serving.

4. Plan meals so as to avoid having leftover vegetables, since the standing and reheating of vegetables contribute further to the destruction of what little is left of some vitamins.

5. Bring the water to the boiling point before adding vegetables. Cook only until tender—no longer. Cook quickly.

6. Use as little water as possible in cooking so as to preserve vitamins, minerals, flavor, color, and texture of food.

7. If water is used, serve the food with the cooking water or use it for soups, gravies, and sauces. This point also applies to juices in canned vegetables. The juices of canned fruits should always be used.

8. Do not add baking soda to vegetables in cooking.

9. Do not expose foods—milk in particular—to light.

10. Store food in the recommended ways. Vegetables and fruits should be refrigerated to retain their vitamin content.

11. Obtain fruits and vegetables, especially greens, as fresh as possible for high vitamin-C content and for palatability. In order to do this, more frequent shopping may be necessary.

12. When preparing frozen vegetables, place directly into boiling water.

13. When vegetables, such as potatoes, must be prepared in advance, place them in the refrigerator after getting them ready and until they are to be cooked or eaten. Keep leftovers in the refrigerator or some other cold place.

Food value of raw, cooked, canned, and frozen foods. Today food is eaten either in its original raw state or is cooked, canned, frozen, or prepared in a number of other ways. The reasons for preparing food by these various methods is to make it more palatable, to make it easier to digest, to keep it from spoiling, to store for later use, or—in recent years—to conserve its nutritive value. A brief summary of the comparative food values of raw, cooked, canned, and frozen foods follows.

Raw foods retain their original values for a period of time, varying with the specific food, nutrient, and conditions. Those foods which keep well, particularly over winter, have been our traditional foods. Examples of such foods are potatoes, carrots, cabbage, turnips, and apples. Those foods which do not keep well should be eaten shortly after being picked or harvested or should be preserved by one of the various methods.

Cooking may lower the food value of foods, particularly as regards mineral and vitamin content, as has been brought out earlier in this chapter. Through careful observation of the better methods of cooking food, it is possible to retain a larger amount of the original food value. However, cooking or preparing food in other ways does not add to the original food value and usually reduces it in some way.

What has been said for cooked food also applies in general to canned food. By modern commercial methods of canning, a relatively large percentage of the original food value is conserved. Home canning methods ordinarily are not so successful in this respect.

Freezing retains more nutritive value than any other method of preparing food. However, foods must be carefully handled before freezing, lest some of their value be lost in preparing for freezing. Commercial food companies attempt to obtain maxi-

American homemakers throw too much good food into the garbage can. Surveys show that the average American wastes about 225 pounds of food a year—a good 6-weeks' supply.

Courtesy U.S. Dept of Agriculture

mum quality in their frozen foods by using the best types, by harvesting at the height of maturity, and by freezing at once. These same procedures apply to home freezing. Through the process of freezing foods, it is possible to have fresh garden produce available the year round. Most of the nutritive value is likely to be saved if the food is used immediately after removal from the freezer. Frozen foods require less cooking than fresh foods, and consequently their nutritive value may be as high as when cooked fresh.

Reducing Food Waste

Food waste is caused by unplanned buying, improper storage, failure to plan the use of leftovers, unpalatable preparation of food, overgenerous servings of food, and failure to utilize all portions of food.

Food waste is extensive. It is important to bring before every person the serious extent of food waste, which is estimated to amount to 30 percent of the food produced on the farm. The big

and little dribbles all along the line, from farm to garbage can, should be of concern to all of us, since such waste increases our food costs. For many people this waste in turn affects the amount of desirable food that they can afford to buy.

As compared with other nations, we have never had to exercise unusual care to prevent these leakages of food. Food has usually been cheaper than labor. We have, consequently, developed careless short cuts in the handling of food which save time at the cost of wasting supplies. We have made our kitchen sinks and our garbage cans the best fed members of the household. We have peeled, sorted, and scraped from our plates an average of 15 percent—a conservative estimate—of all the food which we have brought into our homes.

A study of the edible garbage in New York City for 1 year showed it to be made up of the following percentages measured by weight:

Baked goods (bread, cake, pastry)	14%
Vegetables (beets, carrots, potatoes, etc.)	27%
Citrus fruits (grapefruit, lemons, oranges, limes)	29%
Greens (beet top, cabbage, celery, lettuce, etc.)	23%
Meats, bones, fish	7%

Take a peek into your own garbage can! If there is edible food in it, there is a leak in your family's food budget.

The person who prepares the food has an important role to play as guardian against waste. But you, as the one who will eat that food, have an equal responsibility in the fight on needless waste.

Here are some specific suggestions for attacking this expensive habit of wasting food.

How food waste may be avoided. The following suggestions—which do not necessitate an understanding of technical nutrition information—can be applied in the home to reduce the physical waste of food.

1. In planning and buying foods:
   a. Plan buying with consideration to leftovers, stock on hand, menu planned, cost, and quantity desirable.

b. Check the food in the refrigerator daily so that leftovers are used before spoiling.
c. Use the unavoidable leftovers to the best advantage in other meals.
d. Do not touch fruits and vegetables unnecessarily when shopping as they may be injured when handled.
e. Know size of portions to be purchased and to be served. A.P. (As Purchased) and E.P. (Edible Portion).

2. In preparing foods:
   a. Cook potatoes with skins on. This procedure will save approximately the equivalent of one out of seven potatoes as well as retain more of the vitamin and mineral value.
   b. If vegetables and fruits must be peeled, peel them thin.
   c. Save tops of many vegetables, such as beets and celery, for salads, soups, and other dishes. These parts are rich in vitamins and minerals.
   d. Use outside leaves of cabbage, endive, and lettuce. These leaves are richer in vitamins and minerals than the paler inner ones.
   e. Eat the heels of bread loaves.
   f. If milk or cream sours, use it in making pancakes, waffles, and other items.
3. At the table:
   a. Do not eat more than is necessary.
   b. Do not accept foods that you are unlikely to eat.
   c. Reduce the size of your food portions. If you don't take enough the first serving, you can have a second helping.
   d. Learn to eat all the foods placed before you.
4. When storing foods:
   Conserve your food supply by adopting accepted methods of storage and refrigeration in order to prevent spoilage. A refrigerator can keep food—but not indefinitely.

For Review

1. Name factors which have contributed to increased food production in the United States.

2. Explain why the farm land in this country has deteriorated over the years.
3. What is the relationship between soils and plant and animal growth?
4. What is meant by soil-less gardening?
5. What is meant by contour farming? What is its value?
6. What vitamins are most readily lost during food preparation?
7. What other nutrients may be affected by faulty cooking procedures?
8. Give some practical suggestions for reducing vitamin and mineral losses in food preparation.
9. Give figures on the extent of food waste in the United States.
10. Give several suggestions for saving food in the home.

For Personal Application

1. Keep a record of the amount of food that you personally waste in a day or a week. What is its approximate value in dollars and cents?
2. Check up on the problem of food waste in your home as determined by: (*a*) the kind and amount of edible food thrown into the garbage can; (*b*) wasteful methods of food preparation; (*c*) unscientific cooking procedures; (*d*) faulty methods of food storage and refrigeration; (*e*) which of the faulty methods and procedures found for *a*, *b*, *c*, and *d* could be corrected and how.
3. Check up on the problem of food waste in a restaurant, cafeteria, boardinghouse, or other eating place in the same way as in question 2 (*a* to *e*).
4. If you have a garden at home, be your own soil chemist and make a study of its soil to determine its chemical make-up and fertilizer needs.
5. Find out what the farmers in your county and state are doing to restore and protect the soil and its fertility.
6. Study the rise and fall of various civilizations. Were soil fertility and food probable factors?

16

WE NEED TO SAFEGUARD OUR FOOD

> We must make it easy for average men and women to protect themselves from the unscrupulous who wish to exploit the current interest in what constitutes an adequate diet.
>
> FRANCES PERKINS[1]

People need to be protected against food which has been contaminated by various harmful bacteria. People also need to be protected against the sale of adulterated foods, foods of inferior quality, and false advertising. Some of these problems require government help; others depend upon individual understanding and vigilance.

Food Dangers

Certain bacteria and other microorganisms may spread disease through foods. Here are some of the more common food-borne diseases and the various routes or methods whereby their microorganisms are transmitted to individuals:

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[1] Former Secretary, U.S. Department of Labor.

Disease	*Route to the Individual*
Food infections	Food contaminated by unwashed hands, sores, or boils, or by rats. Underdone meats
Botulism	Home-canned foods improperly prepared
Trichinosis	Insufficiently cooked pork
Amebic dysentery	Water contaminated at the source. Defective plumbing. Food contaminated by unwashed hands or flies
Bacillary dysentery	Water contaminated at the source. Dishes or silverware contaminated by a carrier. Food contaminated by unwashed hands or by flies
Diphtheria	Dishes or silverware contaminated by a carrier. Also by sneezing, coughing, or spitting
Septic sore throat and scarlet fever	Raw milk contaminated at the source
Typhoid fever	Water, milk, or shellfish contaminated at the source. Food contaminated by unwashed hands or flies
Undulant fever	Raw milk contaminated at the source

Bacteria live everywhere. You carry more of these microorganisms on your person than there are people on the earth. They are alive, just as we are, and take in food, give off wastes, grow, and multiply. Theoretically, a single one will produce in 24 hours under favorable conditions 281 trillion other bacteria— each one capable of doing the same. Fortunately, a great number die off by themselves and a great many do no harm.

Most harmful microorganisms grow best at body temperature. High temperatures usually kill them. Freezing does not hurt them any, although it does keep them from multiplying. They are not lovers of light; direct sunlight kills them. Bacteria breed best in the dark, and they need moisture to grow.

Table 9 shows the number of times (rate of increase) that the original number of bacteria, which happened to be present at the start of the particular study, multiplied in 24, 48, 72, and 96 hours. Another experiment might give results differing two to ten times from those recorded in the table. However, the over-all

Courtesy Hotels Statler Co., Inc. (top) and U.S. Public Health Service (left)

All kitchens in restaurants should be as neat and clean as the one above in a large hotel. Unfortunately, some restaurant kitchens actually exist that are as unsanitary as the one shown at the left, which was discovered by a district director of the U.S. Public Health Service.

picture would be similar—that is, there would be a very rapid increase in the rate of growth with increasing temperature. Roughly, the rate of growth of microorganisms is approximately doubled when the incubation temperature is increased 10 degrees centigrade (18°F.).

TABLE 9

Growth of Bacteria in Milk and Meat at Varying Temperatures*

	Temperature (Fahrenheit)	Rate of increase of bacteria			
		24 hours	48 hours	72 hours	96 hours
Milk	35°	2.4	2.6	4.5	5.9
	40°	2.5	3.2	6.3	21.6
	45°	3.4	23.2	83.5	152.5
	50°	10.6	63.5	114.5	2,467.7
	55°	25.4	174.1	849.0	6,483.8
Meat	35°	3	2	7	8
	40°	3	4	24	221
	45°	11	32	2,083	4,894
	50°	32	137	7,420	24,197
	55°	32	4,525	18,879	390,130

* Figures are from *Milk in the Household Refrigerator* and *Meat Keeping in Home Refrigerators*, U.S. Department of Agriculture.

Someone handling food or working in the kitchen may transfer disease-causing bacteria from himself to the food. In one instance, 81 cases of food poisoning resulted from corned beef which had been handled by an employee with an infected, untreated laceration on a finger. Food can also be contaminated by a person who does not actually touch the food but who transmits bacteria to it in droplets from the nose and throat when sneezing and coughing.

According to information that was available to the U.S. Public Health Service in one recent year, the following types of establishments were involved in 264 food-borne outbreaks: public restaurants, 49; schools and colleges, 38; food shops, 31; hospitals and institutions, 29; industrial cafeterias, 19; labor camps, 16; railroad train, 1; private homes, 50; private parties, 14; picnics, 9; and church suppers, 8.

Of the diseases listed on page 269, three of them—food infection, botulism, and trichinosis—are specifically transmitted by food. The other food-borne diseases, such as diphtheria and typhoid fever, may also be transmitted by other means, such as contaminated water. More information is therefore given about these three diseases.

Food infections. Food infections are caused by bacteria. Most cases of so-called food poisoning, or "ptomaine poisoning," as we incorrectly call it, are rarely caused by eating food that has been poisoned but rather by eating food that has been infected.

In a large percentage of food-borne outbreaks, the illnesses resulting may be classified under the symptom-describing term gastroenteritis. These outbreaks are usually one of two types: (1) bacterial infection, in which the germ multiplies in the body, or (2) actual poisoning by a toxin produced by certain types of bacteria. In the case of toxin food poisoning, the food may have been boiled to kill the bacteria but the toxins of the bacteria were not destroyed. Fatalities are rare in either type of infection, with the exception of botulism.

In bacterial infection, a period of 12 to 24 hours or longer intervenes between the eating of the food causing the illness and the onset of symptoms. The infection produces nausea, vomiting, diarrhea, and colic. It is usually accompanied by a fever, and the illness may last several days or longer.

In the toxin food poisoning, the average incubation period is about 3 hours, although it is possible for a person to become ill as early as a $\frac{1}{2}$ hour after eating tainted food or as late as 12 hours afterward. In spite of the apparent seriousness of the condition of the patient at the height of the illness, he usually recovers almost as rapidly as he became ill and within 24 hours feels quite normal, except for some weakness.

A person who has had experience with illnesses from food infection can usually determine what the foods were which caused the trouble. Certain foods can be eliminated from suspicion immediately, since they do not support bacterial growth. They are the foods which are either dry, highly acid, or highly spiced, or which

have concentrations of salt, such as pickles in brine, or of sugar, such as preserves.

Harmful bacteria grow most commonly in cream-filled custard pies and pastries, meat and meat products, shellfish, milk and milk products, poultry, salads, sauces, dressings, and gravies. This does not mean, of course, that other foods may not become contaminated.

Bacteria are especially attracted to milk and eggs. That is why foods made of milk and eggs, such as eclairs, cream puffs, and cream pies, must be kept under cover and refrigerated at all times.

Botulism. Botulism is a serious poisoning caused by a tiny bacterium, called *Bacillus botulinus*, which normally grows in the soil and which finds its way to the canning kitchen on the outside of fruit or vegetables. The symptoms of botulism include headache, nausea, impairment of the vision, difficulty in swallowing and talking, and paralysis.

The bacterium is dangerous because it forms heat-resistant spores which can survive 212 degrees Fahrenheit, the temperature of boiling water, and later mature to produce active germs. Furthermore, this bacterium grows and thrives without oxygen. Consequently, even if jars of vegetables bearing the microorganism are kept at boiling heat for 30 minutes, they may still harbor living spores of botulism. And when the jars are sealed, lack of air will promote rather than inhibit the growth of the spores.

This bacterium produces a toxin in the food when it starts to grow. Botulism is especially dangerous because it is not easily detected. Food which is contaminated with it may show no signs of spoilage. It may not have a bad color or taste and may not even look "spoiled." The toxin itself is so potent that housewives have died from merely tasting a contaminated food to see whether it was "all right."

Fortunately, the deadly bacteria do not flourish in acid. Botulism poisoning usually can be traced to nonacid foods like string beans, chili peppers, beets, or corn. But such foods can be made safe in canning if they are washed carefully. For those who

do not have a pressure cooker for canning, the safest alternative is what bacteriologists call intermittent sterilization, which means boiling the food in the jars on three successive days for 30 minutes each time. Any spores which survive the first boiling will germinate over the two nights. As the actively growing bacteria which come from them are heat-vulnerable, they are killed when the jars are reheated.

When the time comes to use home-canned food—especially if it is nonacid—a final precaution is necessary. The contents of the jars should not even be tasted, much less served cold, until they have been boiled hard for at least 10 minutes. This procedure will destroy botulinus toxin if it should be present.

Trichinosis. For many years health authorities have warned Americans to avoid "pink pork" and to cook pork thoroughly. Yet the United States continues to have the highest trichinosis rate of any country in the world. It is estimated that one American in every six harbors trichinae—tiny worms which also live as parasites in hogs. They are transmitted to human beings through uncooked pork.

The trichinae bore through our muscles, giving us pains like rheumatism and perhaps even killing us. They move through the body so stealthily that severe damage often occurs before its presence is discovered. The trichina gets its name from the Dutch word *trek*, meaning to travel.

Invisible to the naked eye, this parasite can lurk in any cut of pork from the most expensive loin roast to the more lowly frankfurter. Hogs may become infected from eating garbage which contains scraps of infected pork or from rats in which trichinae may pass their life cycle. Most well-raised, well-cured pork is free from these parasites.

Cooking may be relied upon to kill the trichinae, but the cooking must be so thorough that all parts of the meat will be heated to at least 137 degrees Fahrenheit.

Food pests. There are all kinds of food pests, but the most harmful ones to guard against from the viewpoint of health are rats, mice, flies, and roaches. Food pests are found wherever food, garbage, or waste matter is present, and wherever they go they

Courtesy Bureau of Entomology and Plant Quarantine

Houseflies are a common source of disease-bearing bacteria.

Courtesy Bureau of Entomology and Plant Quarantine

Only under a microscope can the colonies of bacteria left by a fly's feet be seen.

leave harmful bacteria and deposit filth. Steps should be taken to eliminate these pests and to prevent them from contaminating food or dishes. The housefly is especially dangerous because it carries the organisms of typhoid fever, diarrhea, cholera, tuberculosis, and other diseases.

Heavy metals.[2] A number of harmful metals may be present in food products. Included are lead, arsenic, antimony, cadmium, copper, and zinc. Excessive amounts of any of these metals may produce poisoning, although trace amounts of some of them are beneficial. The most dangerous are perhaps lead, arsenic, and cadmium.

Some of the metals may be absorbed into food through prolonged contact. Therefore, foods or beverages should not be left in contact with zinc, copper, lead-lined, or cadmium-plated utensils, as the foods may dissolve appreciable amounts of these metals.

Various poisons that contain fluorine, arsenic, or lead are used in the control of insect pests on growing fruits and vegetables. The harvested products on which such poisons have been used may be harmful to a person if the products still bear amounts of chemicals from the poisons.

Cumulative poisoning may result from the use of water from regions where the soil is rich in fluorides or selenium.

Iron, tin, and aluminum containers do not cause food poisoning. Canned foods may be safely left in their original containers after opening, since the cans have been sterilized. In contrast, the ordinary dishes into which a housewife transfers the contents are far from sterile. However, it may be desirable to transfer acid fruits from the tin to glass containers to prevent the development of off-flavors. Such off-flavors do not mean that the food is not safe.

Food Precautions

Food precautions include care in handling food, pasteurization, and sanitation in serving food. Many of the procedures

[2] From *Nutritional Data*, H. J. Heinz Company, Pittsburgh, Pa., 1949, pp. 58–59.

involved are such as can be applied by the average individual in his home or in a public eating place.

General suggestions. A number of things can be done by anyone to prevent food infection:

1. Keep in mind that bacteria do not multiply at low temperatures and that they can be killed by high temperatures.
2. Store perishable foods in the refrigerator.
3. Put foods prepared in advance and leftovers in the refrigerator; never let them stand out in the open at room temperature. If you let the pot cool off, be sure to place a cover on it.
4. Don't depend upon tasting to determine whether food is safe or not.
5. Be sure that any home-canned products which you use have been canned safely.
6. Never use any canned food if it is moldy, comes from a bulging can, or has a bad odor. Even tasting such food is dangerous. When in doubt, throw it out. However, foods may be left in opened cans in the refrigerator just as safely as in other containers.

Pasteurization. Pasteur, the great scientist, demonstrated that, if foods or bacterial cultures are heated to a temperature of 143 to 145 degrees Fahrenheit for 30 minutes, all the ordinary disease-producing microorganisms are destroyed. This procedure is known as pasteurization. Pasteurized products should be used whenever possible. The process is so simple that it can be carried out right at home by placing a container of milk in a pan of water, heating to the required temperature for 30 minutes, and then cooling the milk as rapidly as possible.

The diseases more commonly transmitted through milk include typhoid fever, scarlet fever, diphtheria, septic sore throat, undulant fever, dysentery, and tuberculosis.

Here are some of the significant degrees of temperature, measured in Fahrenheit, as they relate to the pasteurization of milk:

50°—maximum legal or desirable temperature for milk after pasteurization
130°—diphtheria germs killed
133°—septic sore throat germs killed
137–138°—undulant fever germs killed

140°—tuberculosis germs killed
143–145°—pasteurization
160°—cooking begins
170°—vitamin C destroyed
212°—boiling point of water

It is evident that the temperature for pasteurization of milk has been set sufficiently high to kill harmful microorganisms and yet not so high that the quality of the milk is altered.

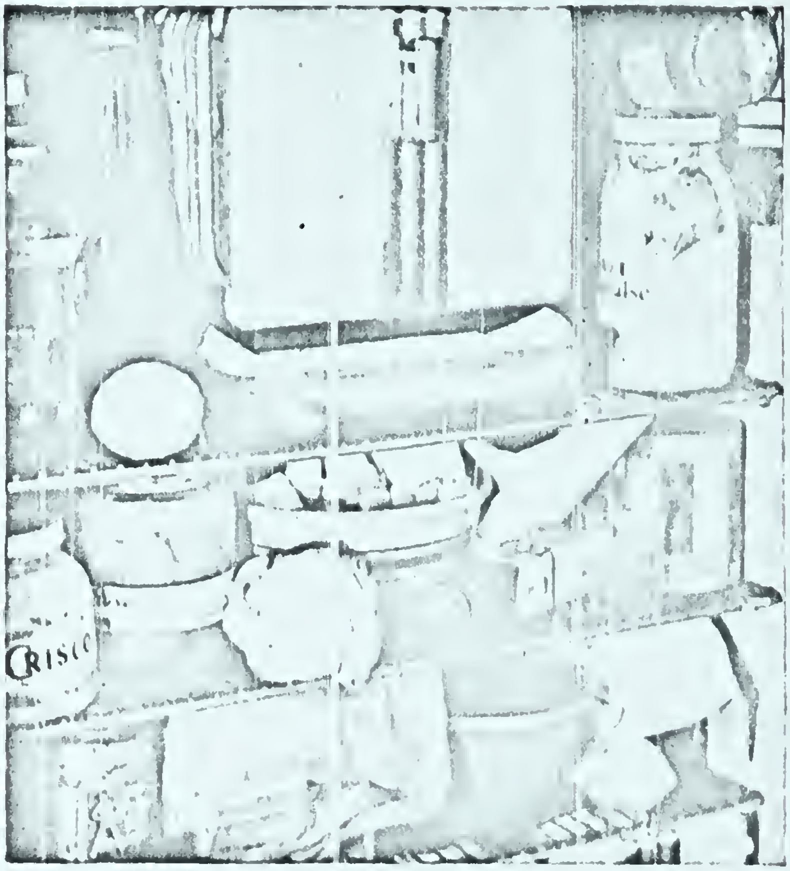
Fortunately, the greater number of bacteria in milk are harmless or, as in the case of milk-souring bacteria, are thought by some authorities to be beneficial to health. Milk which has a very high bacterial content can be used without any detriment to health, provided that disease-producing organisms are absent. It is not the number of bacteria that is important but the kinds. The real danger lies in the chance contamination of milk by individuals who work in the dairy while they are unknowingly suffering from, or are carriers of, any of the food-borne diseases. It is for these reasons that the American Medical Association and the American Public Health Association insist that all milk used for human consumption should be pasteurized. Refer to page 153 for a discussion of various grades of milk based upon their relative safety from harmful bacteria.

The refrigeration of food. Heat is removed from food through the free circulation of cold air. Therefore, anything which interferes with the circulation, such as placing papers on refrigerator shelves, is objectionable. Also, since paper acts as an insulator, it should not be used as coverings of food. Similarly, a refrigerator unit which is heavily coated with ice is less efficient and so needs to be defrosted.

Those foods which deteriorate most quickly—for example, milk and uncooked meats—should be placed in the coldest part of the refrigerator. The coldest part is usually next to the refrigerator unit.

Keeping food in small containers will hasten its cooling. A large container of any food takes considerable time to cool and the food may become dangerous while in the refrigerator. Salads in particular easily become contaminated with harmful organ-

Too much food packed into a refrigerator interferes with the circulation of the cold air and thus prevents proper refrigeration of the food. Many times the food stored in a refrigerator can be stored elsewhere. What foods in this refrigerator do not have to be there?



Courtesy U.S. Dept. of Agriculture

isms, and so salad ingredients should be chilled thoroughly before the salad is prepared. After the salad is prepared, it should be stored in shallow pans in the refrigerator until it is to be eaten.

Cooked foods may be covered in order to prevent the food from absorbing icebox odors, imparting objectionable odors to other foods, the loss of desirable flavors, and drying out. Cooked meat should be covered to prevent drying. Cooked meats do not contain so many bacteria as uncooked meats, and so spoilage is not likely to occur so rapidly.

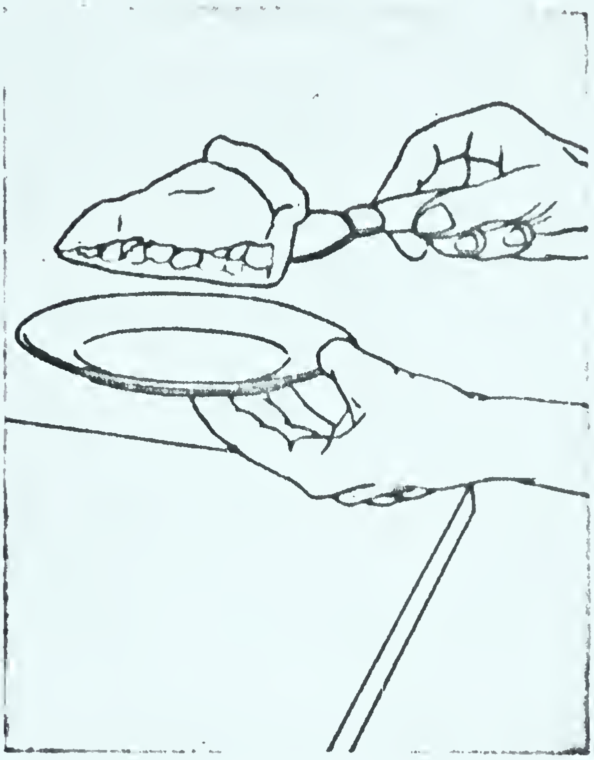
It is best to keep a refrigerator at 34 to 40 degrees Fahrenheit. Higher temperatures, such as up to 50 or 60 degrees Fahrenheit, will permit a marked increase in the growth of bacteria. In a home freezer the temperature should be kept at least below 20 degrees Fahrenheit. Cold-storage warehouses are usually kept below 0 degrees Fahrenheit.

Chemical poisons. In the growing of fruits and vegetables, various chemicals are used to kill or prevent the growth of insects and other plant parasites. Some of these chemicals—for example, those which contain arsenic, lead, or DDT—are harmful to human beings. Therefore, it is important that fresh fruits and vegetables be washed carefully before eating and cooking.

Wrong and Right Ways to

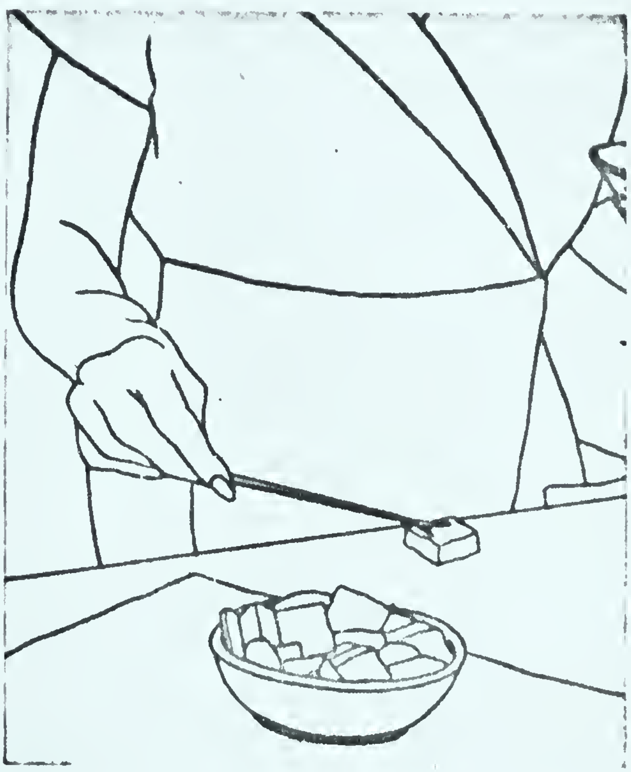
Food

Wrong



Right

Wrong



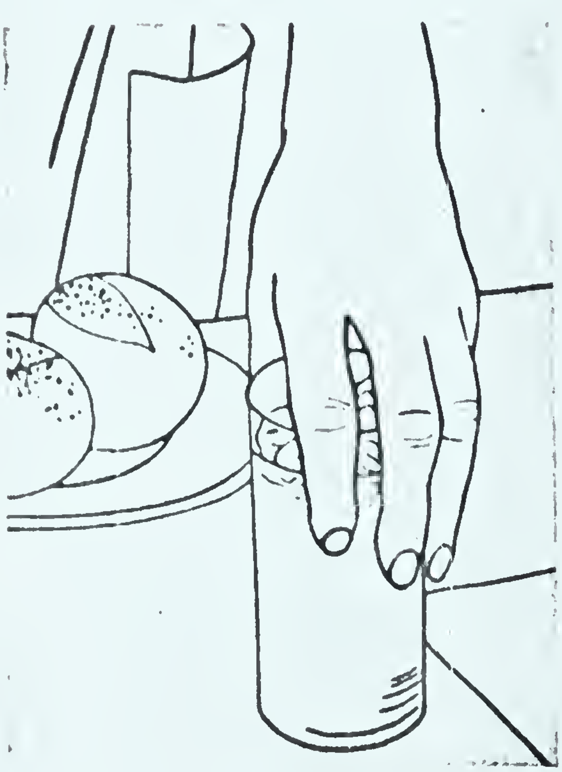
Right

Courtesy Colorado School of Medicine

Tableware

Wrong

Right



Wrong

Right

Courtesy Colorado School of Medicine

Sanitation in serving food. The following advice is usually given to people employed in public eating places, but much of it also applies to you in your own home:

1. Wash your hands thoroughly with soap and water before you touch food or anything that comes in contact with food. No matter how clean you think your fingers are, keep them out of other people's food and dishes. For your own protection, as well as for the safety of others, wash your hands after every visit to the toilet.

2. See that toilet facilities are sanitary, in order to protect food and utensils from fecal contamination carried by flies, other insects, hands, or clothing. According to the U.S. Public Health Service, human excreta are potentially dangerous and must be properly disposed of. The organisms causing typhoid fever, paratyphoid fever, and dysentery may be present in the body discharge of people who have these diseases or who are carriers.

3. Use plenty of soap, or other detergents, cleansers, and hot water when washing dishes. If you wash by hand, use the hottest water that your hands can bear, which will be between 110 and 120 degrees Fahrenheit. If you wash by machine, maintain the temperature of the water at 140 and do not let it fall below 120; rinse dishes with water at a temperature of 170. The U.S. Public Health Service recommends that in public eating places the cleansed dishes stand at least 2 minutes in 170-degree water or 1½ minutes in boiling water. It is almost necessary to apply heat to maintain these temperatures, because the dishes cool the water.

That there is need for improvement in dishwashing methods in many public restaurants is shown by various studies. Recently a comprehensive survey of the conditions of eating and drinking establishments was made in one city. Bacterial counts were made of plates, tumblers, spoons, forks, and beer glasses at different types of places. The lowest count reported— that of 2,800 bacteria—was on spoons at eight soda fountains. The highest count —7,000,000—was on beer glasses in barrooms. The next highest count—390,000—was on tumblers at the eight soda fountains. Each figure is the average "swab count" of 10 utensils. These counts, all of which are greatly in excess of the standard of not

over 100 organisms per utensil surface, show the need for improvement in dishwashing practices in that city.

The use of straws and paper cups and plates at fountains and other public eating places would greatly reduce the dishwashing problem and therefore also reduce the health hazard.

It is unwise to eat in places which you know are unsanitary or about whose sanitation you are in doubt. Particularly in summer, when germs multiply more rapidly because of the higher temperature, patronize only clean eating places. Avoid drinking untested water or milk.

Food Advertising and Food Adulteration

Today we have the food-fad promoter and the food advertiser, where formerly there was the medicine man, the old-fashioned quack doctor, and the patent-medicine vendor.

The food promoter's claims sound rather convincing to the uninformed. He is not always bothered by scientific accuracy, whereas the nutrition scientist is conservative in his statements but accurate in his information. The food promoter uses space in newspapers and magazines and time on the radio and television as a means of passing on to the public his claims. Only to the extent that people understand the facts about foods and nutrition are they able to evaluate and discriminate among the claims of the food advertisers. Fortunately, the public knows more about nutrition than formerly, so people are less likely to fall for certain types of misleading statements.

In recent years many of the food industries have greatly improved the quality of their advertising. Some of them are also making available to the schools and the general public scientifically sound nutrition education materials containing a minimum of advertising.

The Federal Food, Drug, and Cosmetic Act. The federal government does not have the authority to enforce regulations or standards regarding the handling or sale of foods if these are produced and sold within the same state. However, the federal government does have the authority through the Constitution to

Courtesy U.S. Dept. of Agriculture

United States Department of Agriculture inspectors check all meat sold in interstate commerce and place the U.S. government stamp on approved meat so that butchers and consumers may know that the meat has passed inspection.

regulate commerce between states and with other countries. It is on this power that the Pure Food Law was passed in 1906, making it illegal to adulterate and misbrand foods. In 1938 the law was revised and strengthened, and it is now known as the Federal Food, Drug, and Cosmetic Act.[3] The Federal Food and Drug Administration enforces the legislation of the Food, Drug, and Cosmetic Act against the sale of adulterated or misbranded foods. Other forms of misrepresentation of food as may occur in radio advertising and periodicals is the responsibility of the Federal Trade Commission. Many states and cities have certain regulations which go beyond those of the government.

The Act considers that a food is adulterated if it bears or contains any poisonous or deleterious substance which may render

[3] *Federal Food, Drug, and Cosmetic Act and General Regulations for Its Enforcement*, Food and Drug Administration, Federal Security Agency, U.S. Government Printing Office, Washington, D.C., issued 1939, revised 1941.

it injurious to health. Foods which are sold for dietary purposes must be labeled as to their vitamin content and other values. Chemical preservatives and artificial flavors and colors must be declared on the label. Only harmless and certified colors may be used.

Government watchdogs. Ordinarily we are not aware of the amount of protection given us by government "watchdogs" in regard to our foods. The following quotation[4] concerning flour products will give an idea of the variety of problems with which such officials are confronted. The language is quite technical!

It is interesting to reflect as to the manifold chemical influences brought to bear in the technology of such ordinary staple foods as baked products. Let us quickly consider the chemical treatment of the various ingredients used in bakery practice.

The flour is derived from seeds

[4] Emanuel Kaplan and Ferdinand A. Korff, "Exotic Chemicals in Food," *Public Health News*, New Jersey State Department of Health, Trenton, New Jersey, Vol. 28, October, 1946, pp. 143–149.

Courtesy Food and Drug Administration

Men from the Food and Drug Administration of the Federal Security Agency examine food that comes in from other countries as it is unloaded at the docks.

probably treated for plant disease protection with organic mercurials or similar agents and the seeds are planted on soil influenced by fertilizers.

Selenium may be extracted from the soil. (It is one of the few harmful chemicals naturally found in some soils.)

In milling, flour is treated with improvers, oxidizing agents such as persulfate, bromate, iodate and nitrogen trichloride, which affect protease activity and gluten properties.

Bleaching agents such as oxides of nitrogen, chlorine and benzoyl peroxide convert the yellow carotenoid pigment to colorless compounds because of alleged consumer desire for white bread.

Vitamins and minerals are added in compulsory "enrichment."

Mineral salts may be added to stabilize gas-retaining properties of flour gluten.

Cyanide or chlorinated organic compounds may be employed by fumigation of the resulting flour in storage.

Water used may be chemically purified by means of alum, soda ash, copper sulfate, and chlorine.

In refining of sugar, lime, sulfur dioxide, phosphates, and charcoal are employed.

The salt may contain iodide and agents such as calcium and magnesium carbonates to promote "free-running" and prevent caking.

Accordingly, the regulatory official must be increasingly vigilant in the protection of consumer health through an appreciation of the manifold influences of food technology upon the nation's food.

Policies of the American Medical Association

The Council on Foods and Nutrition of the American Medical Association has adopted certain policies[5] for its own guidance and the guidance of the public, food manufacturers, and advertising agencies on food composition, food advertising, and special food questions relating to public health. It defines its views of good food advertising and cautions against certain abuses as follows:

Food advertising must be considered from the points of view of both the public and the food merchandiser. Sound advertising effectively

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[5] *General Decisions on Foods and Food Advertising*, Council on Foods and Nutrition, American Medical Association, July, 1946.

serves the interests of both. The continued welfare of the food industry rests largely on the dedication of its advertising activities to the good of the public. It is essential therefore to define proper food advertising.

Proper food advertising should use the common name of the food concerned, or in the case of a fanciful trade name should identify the ingredients in the order of their decreasing proportions in the product. Such practice prevents deception. Any statement of the physical, chemical, nutritional or physiologic properties and values of the food should be truthful and expressed in simple common terms. Proper advertising is free from false implications. It does not create incorrect or improper inferences or comparisons between foods. It attempts to promote sales solely on the merits of the food article itself.

Good food advertising harmonizes with established authoritative knowledge popularly expressed. Meritorious foods require no exaggerated, false, misleading claims. The inferior food with alleged fictitious values requires gross superlatives and exaggerations, and flamboyant, vague and mysterious claims. Good advertising discusses nutritional values but avoids specific health claims; it recognizes that health depends on the diet as a whole and on many factors other than foods and not on any one food brand nor any one type of food.

The Council considers it "trick advertising" when advertisements contain claims about food which imply that it has valuable merits which it does not have. Such advertisements use wording in such a way as to carry false impressions without making false statements. But the consumer is frequently left with a false impression. For example, in cases in which the food is mixed with milk, the value of the milk may be "played up."

The terms "health food," "healthful," and "wholesome," in relation to food advertising, are defined by the Council on Foods and Nutrition as follows:

> The term *health food* and equivalent claims or statements to the effect that a food gives or assures *health* are vague, misinformative and misleading. An adequate or complete diet and the recognized nutritional essentials established by the science of nutrition are necessary for health, but health depends on many factors other than those provided by such diet or nutritional essentials. No one food is essential for health; there are no health foods. Statements of well-established nutritional or physiologic values of foods are permissible.

The term *healthful* is frequently encountered in food advertising. As used, it commonly means that the food described corrects a possible nutritive deficiency or some abnormal condition in such a manner as actively to improve health. It incorrectly implies that the food possesses unique (or unusual) health-giving properties. The term has a popular specific *health food* significance which makes its use in advertising misinformative and misleading.

Healthful and wholesome by dictionary definition have almost identical meanings; the former, however, intimates an *active* significance, whereas the latter signifies quality or condition. *Wholesome* indicates that a food so described is sound, clean, fit for consumption and free of any objectionable qualities; it is appropriate for characterizing foods fulfilling these qualifications and should replace *healthful* as used in food advertising.

"Educational advertising should be truthfully informative to its intended hearers and readers, and expressed in simple language," according to the Council. Also, "Exaggeration or implication that all the nutritive values reside in a single food or any undue emphasis on the nutritional or physiologic values of any one food is a form of deception."

Many people feel strongly that we need to have both grade labeling and nutritional labeling in the interest of both the consumer and the honest food processor. Such labeling would be of special help to those who understand the basic facts of nutrition.

Fortunately, many of the food industries are recognizing that they have an obligation to the public to advertise truthfully and that in the long run it is to their interest to do so.

For Review

1. Discuss the causes and prevention of food infections.
2. How are communicable diseases spread by foods and drinks?
3. Name some of the foods upon which bacteria readily grow when the temperature is favorable.
4. What is botulism? Trichinosis?
5. What pests are likely to convey germs to food?
6. Explain pasteurization.
7. What diseases can be spread by milk and milk products?

8. How should eating utensils be properly cleaned?
9. Discuss the Federal Food, Drug, and Cosmetic Act as it relates to food.
10. What does the Council on Foods and Nutrition of the American Medical Association consider to be proper food advertising?

For Personal Application

1. Make note of any unsanitary conditions or procedures in some kitchen, cafeteria, or other eating place. How might they be corrected?
2. Determine what regulations your health department has in regard to public eating places and the examination of food handlers.
3. Find out whether there are hand-washing facilities for the food personnel in the various places where you eat.
4. Write to your State Department of Health and your State Department of Agriculture to learn what services are available for the protection of the public from food fraud.
5. Make a study of a number of labels on canned or packaged foods to determine whether they comply with laws and recommendations concerning acceptable advertising.
6. Listen to a number of radio advertisements of foods. To what extent does each seem to be accurate or misleading in your opinion?

17

YOU CAN'T BELIEVE EVERYTHING YOU HEAR ABOUT FOOD

> Food with man is not just food. It is the crossroads of emotion, religion, tradition and habit. That to which we are accustomed seems natural, while the strange seems unnatural and undesirable.
>
> MARK GRAUBARD[1]

Man is an easy victim of superstition and fear about anything for which he lacks the facts. This applies especially to matters of health, and nutrition as a part of health is no exception.

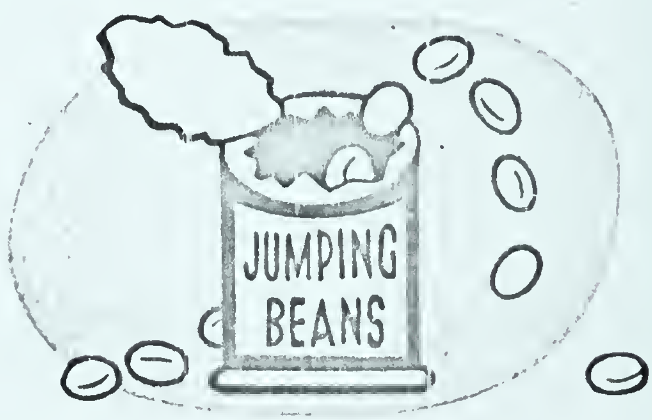
Since the science of nutrition is so recent, it is to be expected that many people do not know the facts about nutrition and that therefore superstitions about food are still held by many people living today. Of course, these people do not realize that some of their misconceptions about food are purely superstitions. They think their information is accurate and factual. The diversity of racial, national, and religious groups from which the people in

[1] Author of *Man's Food: Its Rhyme or Reason*, The Macmillan Company, New York, 1943.

the United States have come has further added to the number of customs and beliefs held by various individuals in this country.

We need skill in recognizing superstitions and false beliefs to which we may be exposed by friends or outsiders. Also we need to exercise sound judgment so that we do not go overboard on some new food idea or cult or so that we do not ridicule something that may have sound merit.

Note how many of the odd customs, beliefs, and superstitions in regard to food and diet which have been believed and practiced somewhere and at sometime in the past, as described in the following pages, are still held by various individuals in this age of science.



Courtesy "Look"

It is said to be perfectly safe to leave food in a can which has been opened. Is this right or wrong? (See page 276.)

Superstitions about Various Foods

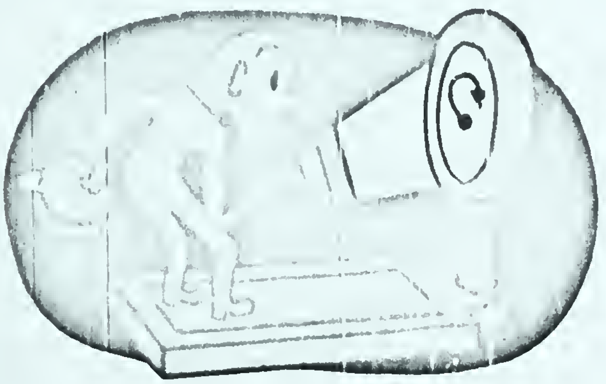
Beliefs which have no scientific basis and are being continued in the face of established scientific facts to the contrary can be labeled superstitions. Some superstitions concerning foods, particularly those held by people years ago, are here discussed.

Erroneous beliefs about meat. Primitive man obtained his meat directly from a captured animal. He held the correct belief that food merges with the human body. But he also wrongly believed that the devouring of anything transferred its properties to the eater. It was held that the heart was the seat of courage, and so the heart of a lion or a human being considered courageous was eaten to gain courage. Because of the great respiratory powers of the fox, eating the fox's lungs was thought to be good for asthma. Ancient people believed that the liver was the seat of mercy, and so they fed liver to the hard and cruel members of their tribes. Also, because a snake is sly and mean, they believed that eating snake meat would make them sly and mean. The same was true

conversely, of course; many primitive people would not eat the flesh of a deer lest they become timid. Some people, even today, will not eat meat because they hold the mistaken idea that eating meat makes men savage.

All records indicate[2] that primitive man availed himself freely of the meat of a variety of animals. Monkeys, snakes, rodents, crocodiles, frogs, fish, insects, spiders, shellfish, and worms were—and still are in some sections of the world—considered desirable food for humans.

Today in some localities of the world snails, eels, and grasshoppers are considered delicacies. Horse meat is eaten in many parts of the world, as is also the flesh of cats or dogs.



Courtesy "Look"

Is food more fattening when eaten at night than in the daytime? If you cannot answer this question, see page 189.

While it is clear that the human race has always eaten everything which may rightly be called flesh or meat, each group develops its own habits and its own favored meats. It also develops its own aversions. Those animals favored by any group as food are regarded as "natural human food," but those that are shunned are considered abominations. The scientific fact is, of course, that all flesh is meat, consisting of proteins, fats, and certain vitamins and minerals.

All meat and fish are prohibited to the highest Indian caste of Brahmins, while beef is prohibited to all Hindus. Chicken or fowl in general is also forbidden as food in some groups. The Eskimos will not eat seal in the deer season and vice versa. In fact, Eskimos are obliged to use different tools and utensils for preparing and cooking the meat of each animal.

Many people in this country today will not eat organ foods, such as liver, heart, kidneys, and brains, although we now know

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[2] Mark Graubard, *Nutrition and Labor: Superstitions and Science in Our Daily Food*, American Federation of Labor, Washington, D.C., 1943.

that the nutritional value of such food is very high. It is as much a matter of becoming accustomed to the *idea* of eating such food as of becoming accustomed to the taste of it.

Today there are still many people who believe that meat is absolutely essential to the performance of hard manual labor, such as mining, lumbering, and, yes, even playing football. Could it be that they expect to be given animal strength from such food? What these individuals need is a balanced diet in which meat takes its normal place in supplying certain nutrients, of which protein is the principal one. Individuals who are already meeting the requirements of the Nutrition Yardstick only need more calories and certain B vitamins when they increase their physical activity. Whether these increased needs are met by eating more meat or some other food is a matter of taste, cost, and availability.

Courtesy "Look"

Regardless of beliefs to the contrary, oysters may be eaten without harm at any time of the year.

False ideas about fish. Like meat, fish too has been the subject of many taboos. Fish may be tabooed by tribes that live on the shores of lakes and seas, much to the detriment of the tribesmen's health, of course. Fish may be prohibited in some places to women only.

A number of people today consider fish as a special brain food. But it should be understood by now that no food "feeds" a specific body organ. This belief came about with the discovery that the brain contains phosphorus and, since fish contains it also, it was thought to be a good source of phosphorus for the brain. Phosphorus from fish or from any other source—such as meat, milk, or vegetables—may eventually end up in any tissue of the body which needs this mineral.

There is another factor involved in the relationship of fish to intelligence. In Chapter 7 it was explained that an inadequate supply of iodine in the diet may result in cretinism. One of the symptoms of this disease is retarded mental development. Iodine,

whether from fish or other sources, will help to cure the ailment when taken early enough.

Taboos about eggs. Primitive man had all kinds of beliefs about eggs[3] which we may well call superstitions. It is strange that this food should have given rise to so many taboos. It was a common notion in Greece, Palestine, and the Orient, for example, that abstaining from foods of blood and life meant being pure. Today in India eggs, together with all items that have life in them, are prohibited to the high castes. Prohibition of eggs prevails in many parts of Africa, Asia, America, and elsewhere. Tribes which consider rats, mice, or dogs as rare delicacies may regard eggs, and chicken meat too for that matter, as disgusting, forbidden food.

Courtesy "Look"

Is a brown egg just as nutritious as a white egg or more so? If you don't know, it means that you have not read this page.

Are you one of the individuals who believe that white eggs are of more value as food than brown eggs (or the reverse)? If so, you are holding a belief that is as superstitious as the taboos of these ancient tribes, for there is no scientific evidence to back up this belief. Note that "color" is not listed in reference to eggs in the tables on nutritive value. Eggshell color depends primarily on the breed of the hen and has no bearing on nutritive value. Before the War Between the States, New England farmers raised Rhode Island Red and Plymouth Rock chickens which laid brown eggs, whereas New York farmers raised White Leghorns which laid white eggs. In those days, a white egg in New England and a brown egg in New York usually indicated an imported, older egg. From this situation a prejudice developed, which still holds, about the quality of the egg in relation to its color.

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[3] Mark Graubard, *Nutrition and Labor: Superstitions and Science in Our Daily Food*, American Federation of Labor, Washington, D.C., 1943, p. 20.

Wrong ideas about fats and oils. Fats and oils played a very important role in the diet of primitive man.[4] Animal fats were enveloped in much romance and sanctity. Great medicinal values were ascribed to them and, as the Bible relates, when animals were sacrificed, their fat was removed and burned separately. The abdominal and kidney fats had such sanctity that they were prohibited as food. Among many groups today fat is still a cherished item of food; an instance of this is the value attached to the blubber of whales by the Eskimo.

Rubbing the body with fat was a common practice in the past. It was done at ritual dances and during primitive equivalents of our confirmation ceremonies. Items which appealed to man's fantasy were often endowed with medicinal powers of great magic. The medicinal fame of fat has survived to modern times. Many people alive today have used lard—or the far more expensive and reputedly more magical bear's fat—for a variety of ailments.

Tradition and custom can exercise considerable weight in food matters. Consider, for example, the custom of coloring butter to bring it to a standard shade of yellow in order to make it acceptable to the consuming public. The same idea has had to be carried over to margarine to get the public to buy it. Understand that this coloring adds nothing of food value, either to the butter or margarine; it supplies only an appearance to which we have become accustomed. Nutritionally the two fats are equal in value now that margarine is fortified with vitamin A, and most people cannot distinguish between the taste of butter and margarine when they are not aware of which one they are eating.

Overemphasis on condiments and spices. Condiments and spices played a greater role in the diet of our people in the past than they do today.[5] It is likely that man's earlier diet was monotonous and his recipes few in number so that the addition

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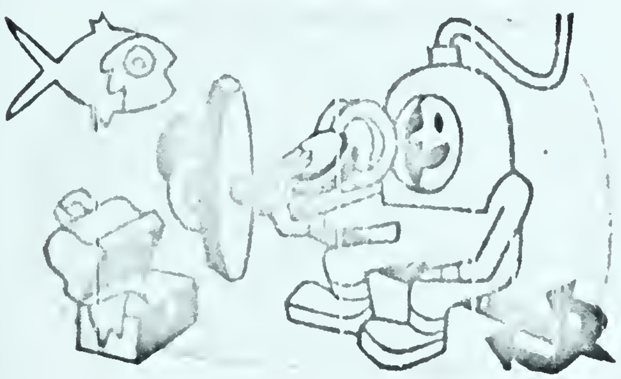
[4] Mark Graubard, *Nutrition and Labor: Superstitions and Science in Our Daily Food*, American Federation of Labor, Washington, D.C., 1943, p. 29.

[5] Mark Graubard, *Nutrition and Labor: Superstition and Science in Our Daily Food*, American Federation of Labor, Washington, D.C., 1943, p. 33.

of relish and sharp-tasting ingredients was pleasing to his palate.

An ancient favorite was garlic which, with onions, forms one of man's oldest vegetables. Both were very popular as spices in Egypt, Greece, and Rome and were believed to have great medicinal powers.

More famous and more highly prized were the spices brought by the enterprising traders of Araby from the remote and romantic Indies. Cinnamon, cloves, nutmeg, ginger, and above all, pepper, meant luxury, wealth, and gluttonous joys to the peoples of the ancient and medieval worlds. Since ancient days, it was believed that they bestowed charm and beauty, acted as love potions, contained the essence of good food, prolonged life, and were potent medicines. The faith in their traditional power was due to the prevalent belief that disease came from foul and bad air. Since spices are pungent and odorous, they therefore were believed to have purified the air and the breath and so banished sickness. They were also supposed to have banished foul and evil spirits and were used as sweet incense to the gods. The desire for spices during and after the Crusades led to war and conquest and discovery of new lands.



Courtesy "Look"

Is it a bad habit for a person to drink water during mealtimes? Give some reasons for your answer. (See page 165.)

Salt, which was man's earliest condiment, has been one of the most important witch elements in spell-casting. It is used in a thousand charms, and there is no country which does not have its share of salt superstitions.

The most commonly acknowledged power of salt was that, when it was spilled at a dining table, a quarrel with a good friend would follow. It was necessary for the spiller to break this misfortune at once by casting a little over his left shoulder. In this way the quarrel with one's friend would be prevented. Why the left shoulder rather than the right one, you ask? The explanation is

that the evil spirits were supposed to congregate on the left side of man, and the salt drove them away and so prevented the evil or misfortune which these spirits were supposed to bring to man.

Among the Romans, salt was considered sacred, and to spill it was an insult to the gods of the home. Many an American homemaker has taken a little salt into her new home before permitting any other supplies to enter the house; and the housewife who follows such a custom probably does not know that she is honoring the ancient household god of Rome.

To put a bit of salt on another man's plate is considered bad luck. But here is the countercharm against the evil thus caused. Repeat the act and put a little more salt on his plate! And some believe that if you would not have bad luck, never return borrowed salt.

Superstitions about fruits and vegetables. If you had been studying nutrition two hundred years ago, here is some of what you would have been expected to learn. We quote[6] from *A Guide to Health*, written by a Dr. Leonard Lynch in 1744, one of the earliest strictly dietetic texts. Maybe you will be amused by some of the spelling used in those days as well as by their ideas about fruits and vegetables.

Plumbs purge Choler, extinguish Heat, take away Thirst in Fevers; but they are bad for weak and cold Stomachs, and for phlegmatic Persons, and such as are subject to Colics. Those of the austere Kind are astringent.

Currants are good in spitting of Blood, extremely cooling, and somewhat astringent. The Jelly or Rob of Currants mix'd with Water, is an excellent Drink in Bilious Fevers.

Strawberries, by their fragrant Smell are Cordial. Their Juice mix'd with that of Limons in Spring-water is an admirable Drink in bilious Fevers.

Oranges that are sweet are more relaxing than the *Seville* Oranges; but these last are an excellent Remedy for the hot Scurvy. The sweet Oranges increase Choler.

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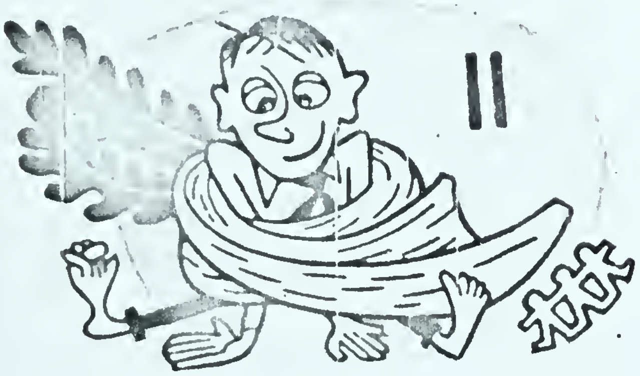
[6] A. J. Lorenz, "Army Hospital Diets—Past and Present," *Journal of the American Dietetic Association*, Vol. 20, July–August, 1944, pp. 430–433.

Citrons or *Limons* excite Appetite, stop Vomiting, cut gross Humours, are good in Fevers, and their Juices are more cooling and astringent than those of Oranges.

Grapes taken in moderate Quantities when ripe, help the Appetite and Digestion; but in great Quantities, they dissolve the Gall too much, and produce Fluxes; and dry'd they are pectoral.

It is also stated that formerly fruits were regarded with suspicion. "And from fruits hold thyn abstinence" we read in the *Gouernayle of Helthe*, written in the fourteenth century, according to the teaching of Galen. This belief was primarily based on coincidence. Diarrheas and fluxes grew in virulence as the summer progressed, and at the same time fruits were beginning to ripen. Consequently, fruits and even vegetables were blamed for the gastro-intestinal ailments which actually were due to bacteria-laden water of the summer days.



Courtesy "Look"

Some people hold the belief that eating celery is an aid to the nerves. Why is this a false idea?

In antiquity and during the Middle Ages very few vegetables were eaten. It was not ignorance that kept vegetables out of man's diet but fashion or the belief that they were not substantial food, as were cereals and meat.

The story of one vegetable—the potato—is especially interesting. In 1584 Sir Walter Raleigh brought potato plants to Ireland and planted them in his garden. A few years later they were brought to London. Before that the Spaniards had imported them into Spain and from there they spread to Italy and France.

The white potato did not gain popular acceptance, however, even in England, although in 1663 the British Royal Academy advocated its cultivation to avoid hunger in case of crop failure. The same reluctance was shown in Germany and France. Crop failures were frequent, and in those days they meant mass starvation. Yet the peasants of Europe clung to their fable that potatoes

poisoned the soil, caused diarrhea, and helped spread the plague. They did use it as animal fodder, though.

For some reason Ireland took kindly to the potato earliest of all nations and did it in earnest. It was only in the days of Napoleon that the potato finally gained popularity in England. It took longer in France and Germany. In France it was a rare delicacy at first, being then served to royalty. During the hunger years before the revolution, Marie Antoinette and Louis XVI tried to popularize the potato among the farmers, owing to the efforts of a scientist named Parmentier. They wore potato flowers at parties and gave potato banquets. It did not help, and they lost their heads on the guillotine.

The struggle that the tomato, formerly known as the "love apple," had for recognition is interesting. When Cortes invaded Mexico in 1519 he found the natives raising a strange new plant called the tomato. It was one of their favorite foods and brought as offerings to their god of healing. The conquerors liked them, too, and brought seed back with them to Spain. However, it was not popular in Europe.

Some people said that sorcerers used it in black magic. Botanists gave it the name Lycopersicon, "wolf of the peach." The people called it the "poisonous love apple." It continued to be feared for many years.

Later the tomato was brought back to America, where it was grown as an ornamental shrub. Eventually it found its place on the American table. It was one of the first foods to be commercially packed by canners. Today we *know* what the Aztecs of Mexico *thought* centuries earlier—that the tomato is a real health food.

Other False Beliefs about Foods

Superstitions have not been limited to people who lived in ancient times or even in the past generation. Neither have they been limited to people of other countries. The fact is that many individuals living today in this country also hold false beliefs about many things. Some of the more common of the misconceptions related to food which are still believed are here explained.

That one shouldn't eat meat. Zoologists divide the mammals—of which man is one—into four distinct classes, according to their bodily structure and their capacity to provide, digest, and assimilate food. These classes are (1) omnivorous animals, who eat nearly everything; (2) carnivorous animals, who live on other animals; (3) herbivorous animals, who eat only plant foods; and (4) frugivorous animals, who restrict their diet to fruits. Since man as a group eats a very large variety of plant and animal foods, he obviously is in the omnivorous group.

Some people hold that man, because of his strong resemblance to the anthropoid apes, which subsist mainly on fruits and nuts, should be placed in the frugivorous class. Where people limit their foods only to plant sources, they are called "vegetarians" and are in the herbivorous or frugivorous classes of animals. Most people who call themselves "vegetarians," however, really mean that they do not eat meat and perhaps fish and fowl; but they do eat foods derived from animals, such as milk, cheese, butter, and eggs. Consequently, they are not real vegetarians but rather are non-meat eaters.

Courtesy "Look"

This glass of orange juice looks sick after being left standing overnight. Is this a correct picture? (See page 131.)

It has been stressed in this book that no one food is absolutely necessary to make possible a well-balanced diet but that certain foods do contribute much toward that end, and meat is one of these groups. A true vegetarian is getting little, if any, complete protein, such as animal proteins supply. The vegetarian who only refuses to eat meat is still obtaining valuable nutrients from other animal sources as, for example, milk and eggs.

To the extent that a change to a vegetarian diet contributes to an increase in the consumption of fruits and vegetables, such a diet will perhaps improve the health of an individual who is deficient in these foods. If the intentional absence of meat in the diet further causes an increase in milk, cheese, eggs, fish, and

fowl, the over-all diet may be well balanced. In fact, it may be an excellent diet.

The point to emphasize is that there is no particular virtue in vegetarianism on either dietary or physiological grounds. Some people base their reasons for being vegetarians on certain religious or historical grounds.

A few people carry the point further and insist on eating only raw, "live" foods instead of cooked ones. It is true, as already emphasized, that various nutrients, such as certain minerals and vitamins, may be lost through cooking. However, this does not mean that we should eat *only* raw food. Sensitive systems may be thrown out of kilter by eating too much raw, coarse-fibered food. Cooking softens the tough connective tissues of meat and bursts the walls of the cells of vegetables, thereby enabling the digestive juices to get at their content. It is true that raw fruits, fruit juices, and salads are very important in our diets.

That need can be judged by appetite. We should learn to distinguish between appetite and actual body needs. If you have a special craving for certain foods, such as sweets, it is not a sign that the body needs it but, rather, it indicates that you have got accustomed to eating sweets.

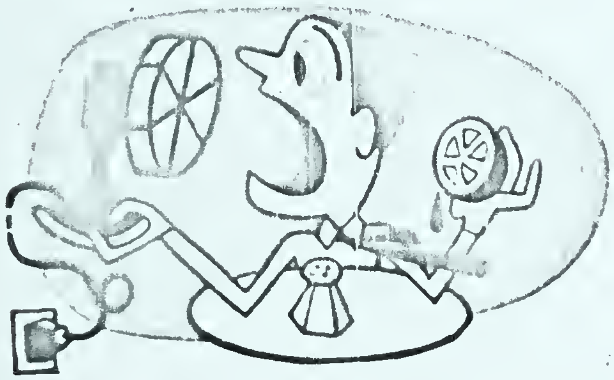
Many people believe that appetite and instinct are accurate guides to diet. They say, "I let nature take care of my food needs" or "When I have an appetite I eat." Considering the large number of individuals who are overweight, it is apparent that the appetite is not a helpful guide for judging when and how to eat. Similarly, in cases of people whose appetites are poor and who do not get sufficient food, it can hardly be claimed that appetite is a guide to eating.

No evidence exists today to prove the belief of some people that we instinctively know what is good or not good for us as regards food. Certain experiments with animals have been interpreted as indicating that animals were able instinctively to know what they should eat. However, Dr. Henry Borsook found, on the basis of carefully designed experiments, that when an animal had become ill with a severe vitamin deficiency it selected the proper food *afterward* only if that food gave quick relief and if it had a

noticeable smell and color. If the relief was slow, or if the curative substance was incorporated in a food which did not have a distinctive smell and color, the animal did not exercise any "wise" selection.

A continuous craving to eat more than is seemingly necessary may be due to hidden hunger or to an emotional disturbance. No doubt individuals in good health will have an appetite that is somewhat reliable if they exercise considerably in work or play and if they have regular habits of mealtime.

That too much acid is bad. It is a commonly held belief that acids in foods are harmful. The Council on Foods and Nutrition of the American Medical Association has the following to say on the subject:



Courtesy "Look"

Do medical authorities hold that tomatoes become acid in the stomach? Yes? No? What do these pages say?

> Acidosis and acid claims, and the words "acidosis," "acidity" and "acid" are frequently used in advertising to play on vague fears of the public. The usual well-balanced diet includes many alkali-yielding foods—milk in its various forms, fruits and vegetables. Acid-forming diets are not a practical nutritional problem because a good modern mixed diet adequate in minerals and vitamins can scarcely be potentially acid. It is appropriate to call attention to the fact that certain foods are potentially alkaline, or yield alkaline mineral residue in the body. . . . The term "acidosis" is so little understood that its use in any advertising except that restricted to the medical profession is misleading and consequently disapproved.

The acid in "acid fruits," or sour-tasting fruits, has nothing to do with body "acidity." In fact, such fruits usually have an alkaline content that is of importance. Such acids are also relatively weak as compared with the normal acidity of the stomach.

That milk and cheese are constipating. It is believed by many people today that milk and cheese are constipating. The mere presence of these foods in our diets is not the cause of constipation. It is, rather, the omission from the diet of certain foods

which supply bulk or roughage, such as fruits, vegetables, and whole-grain bread.

Milk, we have learned, is a liquid which is quickly and thoroughly digested. It contains no roughage and is therefore completely absorbed. Consequently, it contributes no residue which can help in the process of clearing the intestines. The same can be said of cheese. However, these foods in themselves are not constipating if given their proper place in a varied diet.

That certain food combinations are harmful. There is the belief that combinations of certain foods eaten at or near the same time are harmful. For instance, it is held by some people that milk and fish should not be taken at the same meal. No facts of physiology or nutrition substantiate this belief. It no doubt originated in the days before refrigeration when, by coincidence, people who were eating fish that was not strictly fresh also happened to drink milk at that same meal. People who refuse to eat fish and drink milk together probably never think of it as inconsistent when they eat fish chowder made with milk, oyster stew, or fish with cream sauce.

Courtesy "Look"

Do you believe that drinking large quantities of water will tend to increase your weight? (See page 165.)

Some people have the notion that acid fruit and milk do not mix well. Acid of course curdles milk, and so, if fruit acids don't do it, the stomach acids will. Curdling does no harm, but if you wish to avoid it for the sake of appearance, add the juice to the milk slowly, stirring constantly. Fruit juice and milk make a tasty combination when in the form of sherbets.

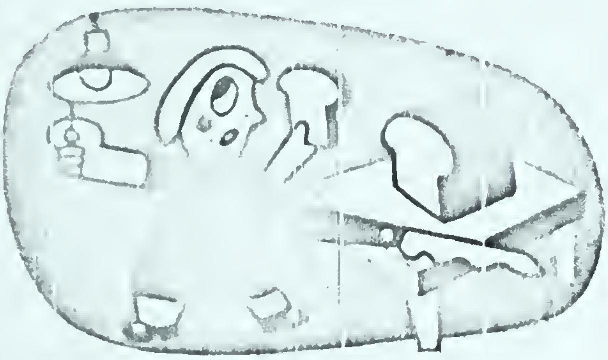
Modern methods of feeding infants further disprove this idea. Actually, several acids are used in this country to acidify cow's milk artificially for infant feeding.

To sum up, then, on the matter of food combinations: If two foods can be eaten separately, they can also be eaten in combination without any harm.

That certain foods are reducing. In Chapter 14 mention is made of various spurious methods of reducing. Here we wish to emphasize that no food has the power to "melt fat away." Some individuals believe wrongly that grapefruit, pickles, lemons, vinegar, and other acid or sour foods have reducing powers.

Gluten bread and coarse bread are sometimes spoken of as having "reducing" properties, because of greater bulk and lower calorie value. But actually such claims have little merit.

It is the total calories consumed that determines whether or not a person will reduce or gain weight. Obviously those foods which are low in calories will help to lower the total daily calorie intake, but beyond that there is nothing to the idea that any specific food will directly contribute to the losing of weight.



Courtesy "Look"

Some women who are trying to diet say that white bread is more fattening than dark bread. Are they right? If you don't know, consult Table 10 in the Appendix.

The American Medical Association advises that in food advertising the use of the term "energy," in defining the calorie value—or energy value—of foods, should not be confused with the popular usage signifying activity, vitality, strength, vigor, or endurance.

Also, for healthy persons, calories from one food are not to be regarded as of more value than those from any other foods. Don't be misled by false advertising.

It is our great fortune to be living in an age when our food habits can be based upon scientific knowledge of foods rather than upon superstitions or trumped-up ideas. It is our job to take advantage of this scientific knowledge and apply it to our daily living.

For Review

1. What are some factors which explain why certain people are superstitious?

2. To what extent can traits of an animal be passed on to the individual who eats parts of that animal?
3. What are some of the superstitions associated with salt?
4. How was the potato popularized in Europe years ago?
5. What is a "vegetarian"?
6. To what extent can man rely upon his instinct as a guide to what he should or should not eat?
7. Is it all right to have both fish and milk at the same meal?
8. What are some foods which incorrectly are thought to aid in reducing?

For Personal Application

1. Make a list of superstitions dealing with food and nutrition in addition to those mentioned in this chapter. On what scientific information do you base your belief that each is a superstition?
2. Prepare a true-false test of 20 questions on food and nutrition, 10 of which are superstitions or other misconceptions, and 10 others which are scientifically correct. Then give this test to a number of individuals or a group to see what scores they can get on the test. Try to find out why each person who took the test held certain incorrect beliefs. Where had these wrong ideas been acquired?
3. Make a study of the eating and dining habits of some racial group. How do some of their customs differ from your own? What explanations can you give for these differences?

APPENDIX A

FOOD VALUE TABLES

Table 10: Food Value Table for Calculation of Diet Records

Table 11: Analysis of Alcoholic Beverages

Table 12: Weights and Measures

APPENDIX A

Food Value Tables

Explanation of Table 10. The nutritive value of over 200 foods, listed alphabetically, is given in Table 10[1] on pages 310 to 349. The amount of food for which values are given is expressed in household measures or by dimensions in inches. Equivalents in terms of weight by grams are also given. The amounts appearing in the table do not necessarily represent servings, but rather convenient units of measurement which may be used in calculating diet records. In setting up values for meats, dimensions are given for meat after cooking; weights (except for prepared ready-to-eat meat products) are given for meats before cooking.

In developing this table, foods that are very similar in composition, such as certain cereals, have been grouped and an average value used. A single figure has been given for each of three groups of fish, commonly classified according to the fat and protein content.

Many foods are eaten as prepared dishes for which proportions of the various ingredients cannot readily be obtained. Diet records were surveyed to determine the prepared dishes most frequently used. Values for such items included in the table have been calculated from recipes in standard cookbooks with modifications based on cooking practices observed in the course of field studies.

The table includes values for raw foods and for cooked foods for which usable data are available. Estimated cooked-food values for meat and vegetables are based on average values of cooking losses and may need to be modified in areas where cooking practices differ

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[1] *Food Value Table for Calculation of Diet Records*, Public Health Service, Federal Security Agency, Washington, D.C., 1948.

a great deal from the average. Cooking losses were estimated for a few other foods for which there are less adequate data.

The fat content of fried potatoes, fried eggs, and doughnuts has been computed and included in the table.

The data contained in the Food Value Table were obtained from the following sources:

Bowes, Anna deP., and Charles F. Church. *Food Values of Portions Commonly Served.* Philadelphia Child Health Society, 1946.

Cooper, Lenna F., Edith M. Barber, and Helen S. Mitchell. *Nutrition in Health and Disease.* J. B. Lippincott Company, Philadelphia, 1941.

Experiment Station Research on the Vitamin Content and the Preservation of Foods. Miscellaneous Publication 536, U.S. Department of Agriculture, Washington, D.C., 1944.

The Food Values of Breakfast Cereals. Cereal Institute, Inc., Chicago, 1947.

MacLeod, Grace, and Clara Mae Taylor. *Rose's Foundations of Nutrition.* The Macmillan Company, New York, 1944.

Proudfit, Fairfax T., and Corinne Hodgen Robinson, *Nutrition and Diet Therapy.* The Macmillan Company, New York, 1946.

Proximate Composition of American Food Materials. Circular 549, U.S. Department of Agriculture, Washington, D.C., 1940.

Tables of Food Composition in Terms of Eleven Nutrients. Miscellaneous Publication 572, U.S. Department of Agriculture, Washington, D.C., 1945.

Tables of Vitamin Losses in Cooking of Foods. Committee on Food Composition, National Research Council, Washington, D.C., 1946.

Taylor, Clara Mae. *Food Values in Shares and Weights.* The Macmillan Company, New York, 1942.

Vitamin Values of Food in Terms of Common Measures. Miscellaneous Publication 505, U.S. Department of Agriculture, Washington, D.C., 1942.

Commercial companies which provided information on the weights and measures of their products.

An analysis of alcoholic beverages is given in Table 11 on page 352. This information is included so that the reader may obtain a better understanding of the relationship of alcohol to the diet, as discussed in Chapter 13.

Weights and measures with their equivalents and abbreviations, as used in this book, are listed in Table 12 on page 354.

TABLE 10

Food Value Table for Calculation of Diet Records

(For explanation of all footnotes, see page 351)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
1. Almonds	1 C shelled	120	768		22.3
2. Apple Betty[1]	½ C	. . .	158	Trace	2.0
3. Apple pie (2 crusts 9″ dia.)	⅙	. . .	355		(3.9)
4. Apples	1 small 2¼″ dia.	100	64		0.3
5. Applesauce, canned	½ C	100	80		0.2
6. Apricot pie[1] (2 crusts 9″ dia.)	⅙	. . .	343		3.6
7. Apricots					
Canned	6 halves and 3 T juice	100	89		0.6
Dried	10 halves	35	102		1.8
Fresh	2 medium	100	34		0.6
8. Asparagus, green and blanched					
Canned	8–10 small tips	100	21		1.6
Fresh					
Cooked	1 stalk 5″ long	8	2		0.2
Raw	1 stalk 5″ long	8	2		0.2
9. Avocados	½	100	265		1.7
10. Baked apple[1]	1 of 3″ dia.	. . .	135		0.4
11. Bananas	1 medium 6″ long	100	99		1.2

Explanation of symbols:

0 None present.

Trace Small values that would have rounded to zero.

. . . No reliable data available.

( ) Imputed value, usually from some other form of the same food or similar foods.

Fat	Carbo-hydrate	Calcium	Phos-phorus	Iron	Vita-min A	Thi-amine	Ribo-flavin	Niacin	Ascor-bic acid
(gm)	*(gm)*	*(mg)*	*(mg)*	*(mg)*	*(I.U.)*	*(mg)*	*(mg)*	*(mg)*	*(mg)*
64.9	23.5	305	570	5.3	0	.30	.80	5.5	Trace
3.6	29.6	(17)	(29)	(0.6)	192	(.07)	(.04)	(0.6)	4
(12.8)	(56.0)	(15)	(29)	2.5	(0)	(.07)	(.05)	0.5	(0)
0.4	14.9	6	10	0.3	90	.04	.02	0.2	5
0.1	19.7	(4)	(6)	(0.2)	(60)	.01	.01	Trace	1
14.4	49.8	15	40	(1.1)	1,260	(.14)	(.09)	(1.3)	4
0.1	21.4	(10)	(15)	(0.3)	1,350	.02	.02	0.3	4
0.1	23.4	30	42	1.7	2,600	Trace	.06	1.2	4
0.1	7.7	10	14	0.3	1,674	.02	.02	0.4	2
0.3	3.0	20	34	1.0	600[2]	.06	.09	0.8	15
Trace	0.3	2	5	0.1	80	.01	.01	0.1	2
Trace	0.3	2	5	0.1	80	.01	.01	0.1	3
26.4	5.1	10	38	0.6	290	.12	.15	1.1	16
0.5	32.4	8	13	0.4	117	.01	.01	Trace	1
0.2	23.0	8	28	0.6	430	.09	.06	0.6	10

(Continued on next page)

TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
12. Beans					
Canned					
Baked, with tomatoes	½ C	100	117		5.7
Baked, without tomatoes	½ C	100	117		5.7
Lima, green	⅔ C	100	72		3.8
Snap, string	½ C	100	19		1.0
Dried					
Common or kidney	½ C cooked	100	117		5.7
Lima	½ C cooked	100	117		5.7
Fresh					
Cooked					
Lima, green	⅔ C	100	131		7.5
Snap, string	½ C	100	42		2.4
Raw					
Lima, green	⅔ C	100	131		7.5
Snap, string	½ C	100	42		2.4
13. Beef					
Cooked (all methods and all cuts)	3½ oz	100	235	18.2	
Hamburger steak	2 cakes 2½″ dia. ½″ thick				
Loin steak	1 steak 3″ × 4″ × ½″				
Rib roast or steak	2 slices 4″ × 3″ × ¼″				
Round steak	1 slice 2½″ × 2⅜″ × ¾″				
Stew meat (73% lean)	3 pieces 1¼″ × 1¼″ × 1″				
Corned beef, canned	1 slice 3″ × 2″ × ¼″	25	58	6.1	
Corned beef, cooked	2 slices 7″ × 2″ × ¼″	120	346	19.0	
Dried or chipped beef	1 slice 4″ × 5″	15	29	5.1	
Dried or chipped beef, creamed[1]	½ C	...	182	9.7	0.6
Hash, beef[1]	½ C	...	303	10.7	1.5
Meat balls[1]	1 ball 1½″ dia.	...	158	7.2	0.8
Meat loaf[1]	1 slice 4″ × 2½″ × ½″	...	158	7.2	0.8
Meat potpie[1]	1 serving	...	264	6.9	4.3
Stew with vegetables[1]	1 C	...	203	8.2	2.6

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
2.0	19.0	(49)	(154)	(3.4)	70[3]	.05	.05	0.8	4[3]
2.0	19.0	(49)	(154)	(3.4)	(0)	.05	.05	0.8	(0)
0.3	13.5	27	73	1.7	130	.03	.05	0.5	8
0	3.8	27	19	1.4	410	.03	.05	0.3	4
2.0	19.0	(49)	(154)	(3.4)	(0)	.05	.05	0.8	(0)
2.0	19.0	(49)	(154)	(3.4)	(0)	.05	.05	0.8	(0)
0.8	23.5	63	158	2.3	280	.18	.11	0.7	16
0.2	7.7	65	44	1.1	630	.06	.08	0.5	10
0.8	23.5	63	158	2.3	280	.25	.14	0.9	32
0.2	7.7	65	44	1.1	630	.08	.10	0.6	19
18.0	0	11	196	2.7	(0)	.06	.13	4.4	0
0	0	10	30	1.0	0	0	.05	0.7	0
0	0	10	200	2.9	0	.02	.08	1.0	0
0.9	0	3	56	0.8	(0)	.02	.03	0.6	0
12.0	8.1	103	157	1.3	439	.09	.19	1.1	1
22.1	13.7	17	159	2.2	129	.09	.11	3.6	6
10.9	6.9	59	115	1.2	131	.08	.14	1.6	2
10.9	6.9	59	115	1.2	131	.08	.14	1.6	2
9.5	33.3	53	151	2.2	1,399	(.18)	(.17)	3.0	7
8.3	21.2	33	149	2.1	1,822	.10	.11	2.9	9

(Continued on next Page)

TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
14. Beet greens					
Cooked	½ C	100	33		2.0
Raw	½ C	100	33		2.0
15. Beets					
Canned	⅔ C	100	39		1.0
Fresh					
Cooked	½ C	80	37		1.3
Raw	½ C	80	37		1.3
16. Biscuits					
Baking powder[1]	1	...	112	0.7	2.3
Sour milk[1]	1	...	105	0.7	2.3
17. Blackberries	¾ C	100	65		1.2
18. Blackberry pie[1] (2 crusts 9″ dia.)	⅙	...	329		3.7
19. Blueberries	⅔ C	100	68		0.6
20. Blueberry pie[1] (2 crusts 9″ dia.)	⅙	...	336		3.4
21. Bologna	1 slice 4½″ dia. ⅛″ thick	30	65	4.4	
22. Bouillon cubes	1 cube	5	13	0.9	
23. Brains, beef	2 pieces 2½″ × 1½″ × 1″	100	127	10.5	
24. Bran flakes, prepared whole-grain wheat cereal					
All bran, 100%	½ C	30	96		3.6
Bran flakes, 40%	1 C	30	102		2.9
25. Bread					
Rye, light	1 slice ⅜″ thick	20	53		(1.3)
White, enriched	1 slice ⅜″ thick	20	52		1.7
White, enriched, dry crumbs	1 T	5	13		0.4
White, enriched, toasted	1 slice ⅜″ thick	17	53		1.7
Whole-wheat	1 slice ⅜″ thick	20	52		1.9
Whole-wheat, toasted	1 slice ⅜″ thick	17	52		1.9

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
0.3	5.6	[4]	45	3.2	6,700	.04	.14	0.2	17
0.3	5.6	[4]	45	3.2	6,700	.05	.17	0.3	34
0	8.7	15	29	0.6	20	.01	.03	0.1	5
0.1	7.7	22	34	0.8	16	.01	.03	0.2	4
0.1	7.7	22	34	0.8	16	.02	.04	0.3	8
3.3	17.4	28	39	(0.6)	33	(.10)	(.09)	(0.8)	Trace
2.5	17.5	(28)	39	(0.6)	Trace	(.10)	(.09)	(0.8)	Trace
0.8	13.2	36	34	0.9	320	.03	(.07)	(0.3)	23
14.7	45.4	25	45	(1.3)	178	(.14)	(.11)	(1.2)	13
0.6	15.1	16	13	0.8	280	(.03)	(.07)	(0.3)	16
14.6	47.5	15	34	1.3	175	(.14)	(.12)	(1.2)	10
4.8	1.1	3	48	0.7	(0)	.09	.09	0.9	0
0	2.4	2	26	0.5	(0)	Trace	.04	Trace[5]	(0)
0	0	Trace	Trace	2.3	0	.20	.13	3.3	9
1.1	18.0	27	372	3.0	(0)	.10	.08	5.5	0
0.6	21.0	17	170	1.4	(0)	.12	.05	2.3	0
(0.7)	(10.0)	(4)	(19)	(0.2)	(0)	.03	(.01)	(0.2)	0
0.4	10.0	(11)	(20)	(0.4)	(0)	(.05)	(.03)	(0.4)	0
0.1	3.0	(3)	(5)	(0.1)	(0)	(.01)	(.01)	(0.1)	0
0.4	10.5	(11)	(20)	(0.4)	(0)	(.04)	(.03)	(0.4)	0
0.7	9.0	(12)	74	0.5	(0)	.06	.03	0.7	0
0.7	9.0	(12)	72	0.5	(0)	.04	.03	0.7	0

(Continued on next page)

TABLE 10 (Continued)

Food item	Household measure	Weight	Food energy	Protein	
				Animal	Vegetable
		(gm)	(cal)	(gm)	(gm)
26. Bread pudding[1]	1/2 C	...	200	5.8	1.7
27. Broccoli, fresh					
Cooked	1/2 C	100	37		3.3
Raw	1/2 C	100	37		3.3
28. Brown Betty[1]	1/2 C	...	158	Trace	2.0
29. Brown sugar	1 T	11	42		(0)
	1 C	180	688		(0)
30. Brownies	1 average	10	44		0.6
31. Brussels sprouts, fresh					
Cooked	6 sprouts	70	41		3.1
Raw	6 sprouts	70	41		3.1
32. Butter	1 t	5	37	Trace	
	1 T	14	103	0.1	
	1/2 C	113	828	0.7	
	1 pat	7	51	Trace	
33. Buttermilk, cultured and churned	1 C	245	86	8.6	
34. Cabbage, fresh					
Cooked	2/3 C	100	29		1.4
Raw	5/8 C shredded	50	14		0.7
35. Cakes					
Chocolate[1]	1 serving 3″ × 2″ × 1″	...	223	1.0	2.6
Fruit[1]	1 serving 2″ × 2″ × 1/4″	...	96	1.7	
Plain, light batter[1]					
With no icing[1]	1 piece 2 1/2″ cube	100	327		6.4
	1 piece 3″ × 2″ × 1″ or 1 cup cake	40	131		2.6
With boiled icing[1]	1 wedge of 2 1/3″ or 1 piece 3″ × 2″ × 1″ or 1 cup cake	...	253	0.8	2.6
	1 wedge of 1″	...	108	0.4	1.1
With fudge icing[1]	1 wedge of 2 1/3″ or 1 piece 3″ × 2″ × 1″ or 1 cup cake	...	329	0.5	2.9
	1 wedge of 1″	...	141	0.2	1.2

Fat	Carbo-hydrate	Calcium	Phos-phorus	Iron	Vita-min A	Thi-amine	Ribo-flavin	Niacin	Ascor-bic acid
(gm)	(gm)	(mg)	(mg)	(mg)	(I.U.)	(mg)	(mg)	(mg)	(mg)
7.9	24.7	162	158	0.8	382	.11	.28	(0.6)	1
0.2	5.5	130	76	1.3	3,500	.06	.17	0.7	59
0.2	5.5	130	76	1.3	3,500	.09	.21	0.9	118
3.6	29.6	(17)	(29)	(0.6)	192	(.07)	(.04)	(0.6)	4
(0)	(10.5)	8[6]	4[6]	0.3	(0)	(0)	(0)	(0)	(0)
(0)	(171.9)	137[6]	67[6]	4.7	(0)	(0)	(0)	(0)	(0)
1.3	7.5	(2)	(6)	(0.1)	(0)	Trace	Trace	Trace	0
0.4	6.2	24	55	0.9	280	.06	(.03)	(0.2)	33
0.4	6.2	24	55	0.9	280	.08	(.04)	(0.2)	66
4.0	Trace	1	1	.01	165[7]	Trace	Trace	Trace	0
11.3	0.1	2	2	.03	462[7]	Trace	Trace	Trace	0
92.0	0.5	18	18	.20	3,729[7]	Trace	.01	0.1	0
5.7	Trace	1	1	.01	231[7]	Trace	Trace	Trace	0
0.2	12.5	(289)	(228)	(.17)	(Trace)	(.10)	(.44)	(0.2)	(2)
0.2	5.3	46	31	0.5	80	.05	.05	0.2	26
0.1	2.6	23	16	0.2	40	.04	.03	0.2	26
7.7	34.7	25	60	(0.9)	223	(.11)	(.11)	(0.8)	Trace
3.2	15.0	28	43	1.3	46	...	...	...	...
8.2	57.0	62	(126)	2.0	...	.03	.10	0.7	0
3.3	23.0	25	(50)	0.8	...	.12	.04	0.3	0
4.9	49.2	33	(80)	1.3	160	.14	.07	0.3	0
2.1	20.9	14	(34)	0.5	69	.02	.03	0.1	0
8.4	60.2	43	(81)	1.1	99	.13	.07	0.4	Trace
3.6	25.7	19	(34)	0.4	42	.01	.04	0.1	Trace

(Continued on next page)

TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
36. Cantaloupe	1/4 melon of 5″ dia.	100	23		0.6
37. Carrots					
Canned	1/2 C	100	30		0.5
Fresh					
Cooked	2/3 C cubed	100	45		1.2
Raw	2/3 C cubed	100	45		1.2
	1 medium 4″ long or 1/2 C grated	50	22		0.6
38. Catsup, tomato	1 T	15	16		0.3
39. Cauliflower, fresh					
Cooked	3 flowerets 2″ dia.	75	23		1.8
Raw	3 flowerets 2″ dia.	75	23		1.8
40. Celery, fresh					
Cooked	1/2 C of 1/4″ pieces	60	13		0.8
Raw	1 heart or 4 pieces 7″ long	60	13		0.8
41. Chard, fresh					
Cooked	1/2 C	100	25		1.4
Raw	1/2 C	100	25		1.4
42. Cheese					
Cheddar-type	1 slice 3 1/4″ × 3 1/4″ × 1/8″	23	90	5.5	
Cheddar-type, grated	1 T	7	28	1.7	
Cottage	1/2 C	120	121	23.0	
	1 T	15	15	2.9	
Cream	1 package (3 oz)	85	312	6.0	
	1 T	14	51	1.0	
All other	1 oz (1″ cube)	28	110	(6.7)	
43. Cherries					
Canned, pitted	1/2 C	100	86		0.6
Fresh					
Pitted	1/2 C	100	68		1.1
With pits	20–25 small or 15 large	100	64		1.0
44. Cherry pie[1] (2 crusts 9″ dia.)	1/6	...	369		3.7

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
0.2	4.6	17	16	0.4	3,420[8]	.06	.04	0.8	33
0.4	6.1	22	24	0.6	12,000	.03	.02	0.3	2
0.3	9.3	29	37	0.8	12,000	.05	.05	0.4	3
0.3	9.3	39	37	0.8	12,000	.07	.06	0.5	6
0.2	4.6	20	18	0.4	6,000	.04	.03	0.2	3
0.1	3.7	2	3	0.1	(282)	.01	.01	0.3	2
0.2	3.7	16	54	0.8	68	.06	.06	0.3	26
0.2	3.7	16	54	0.8	68	.08	.08	0.4	52
0.1	2.2	30	24	0.3	0	.01	.02	0.2	2
0.1	2.2	30	24	0.3	0	.02	.02	0.2	4
0.2	4.4	[9]	36	4.0	2,800	.04	.10	0.2	19
0.2	4.4	[9]	36	4.0	2,800	.06	.13	0.2	38
7.4	0.4	201	140	(.13)	400	.01	.12	(0.1)	(0)
2.3	0.1	61	43	(.04)	122	Trace	.04	(Trace)	(0)
1.0	5.2	98	316	(.55)	(36)	.02	.35	(0.1)	(0)
0.1	0.6	12	39	(.07)	(4)	Trace	.04	(Trace)	(0)
31.4	1.4	(253)	(177)	(.14)	1,878	(.01)	.12	0.1	(0)
5.2	0.2	(42)	(29)	(.02)	309	(Trace)	.02	Trace	(0)
(9.0)	(0.5)	(244)	(171)	(.16)	574	.01	.15	0.1	(0)
0.1	20.8	(11)	(14)	(0.3)	(430)	.03	.02	0.2	3
0.5	14.8	...	...	...	...	.05	...	...	...
0.5	14.0	...	...	...	...	.05	...	...	...
14.4	56.4	(15)	39	1.1	(358)	(.15)	(.09)	(1.2)	2

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TABLE 10 (*Continued*)

Food item	Household measure	Weight	Food energy	Protein	
				Animal	Vegetable
		(gm)	(cal)	(gm)	(gm)
45. Chicken					
Canned, boned	1/4 C	50	88	10.9	
Roast	3 slices 3 1/2″ × 2 1/2″ × 1/4″	100	175	21.8	
46. Chile con carne[1,10]	1 C	...	366	14.6	6.5
47. Chocolate					
Milk chocolate bar	1 5-cent bar	45	239		3.2
Milk chocolate bar with almonds	1 5-cent bar	35	201		3.1
Unsweetened	1 square	30	171		(1.6)
48. Chocolate malted milk[1]	1 C	...	287	7.8	0.3
49. Chocolate meringue pie (1 crust 9″ dia.)	1/6	...	357		(4.5)
50. Chocolate milk shake[1]	1 C	...	469	10.6	0.6
51. Chocolate pudding[1]	1/2 C	...	219	3.4	(0.5)
52. Chocolate sirup[1]	1 T	...	65		0.2
	1/4 C or 4 T	...	260		0.8
53. Chop suey with soy sauce[1]	1/2 C	...	266	9.8	0.9
54. Cocoa					
Dry	1 T	9	30		(0.8)
Cooked					
With all milk[1]	1 C	...	224	8.6	(0.5)
With milk and water[1]	1 C	...	139	4.2	(0.5)
55. Coconut, dry, shredded	1 T	5	29		0.2
	1/3 C	30	174		1.1
56. Coconut custard pie (1 crust 9″ dia.)	1/6	...	357		(4.5)

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
4.9	0	16	(109)	(1.0)	Trace	Trace	.08	1.8	1
9.8	0	32	(218)	(1.9)	Trace	.01	.15	3.7	2
21.2	22.8	(66)	(330)	(6.0)	946	.13	.17	4.8	7
14.5	23.8	86	89	1.1	64	.04	.22	0.1	(0)
13.4	17.1	72	87	1.0	47	.04	.18	0.2	0
15.9	(5.4)	[11]	103	0.8	(0)	Trace	.07	0.3	(0)
13.3	34.0	253	221	0.4	(441)	.10	.38	0.1	1
(15.8)	(49.6)	32	(61)	0.8	(0)	.05	.13	0.3	(0)
21.8	57.2	355	319	0.5	(662)	.12	.55	0.2	2
8.6	31.5	116	122	0.3	(157)	.04	.19	0.2	1
2.0	11.6	(0)	13	0.1	(0)	Trace	.01	Trace	(0)
8.0	46.4	(0)	52	0.4	(0)	Trace	.04	Trace	(0)
21.4	7.8	26	127	1.9	68	.41	.12	2.4	12
1.7	(2.8)	[12]	64	0.2	(0)	Trace	.04	0.2	(0)
10.7	22.6	289	271	0.3	(392)	.10	.45	0.3	2
5.8	16.8	142	155	0.3	(192)	.05	.22	0.2	1
2.0	2.7	2	10	0.2	0	Trace	Trace	Trace	(0)
11.7	16.0	13	57	1.1	0	Trace	Trace	Trace	(0)
(15.8)	(49.6)	32	(61)	0.8	(0)	.05	.13	0.3	(0)

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
57. Coleslaw[1]					
With boiled dressing	½ C	...	39	0.6	0.6
With cream-and-vinegar dressing	½ C	...	43	0.4	0.6
58. Collards					
Cooked	½ C	100	50		3.9
Raw	½ C	100	50		3.9
59. Cookies, assorted	1 average	10	44		0.6
60. Corn, sweet, white or yellow					
Canned	½ C	100	77		2.0
Fresh					
Cooked	½ C	100	108		3.7
Raw	½ C	100	108		3.7
61. Corn bread[1]					
Enriched meal	1 serving 2½″ × 2″ × 1″ or 1 muffin	...	156	2.4	2.9
Unenriched meal	1 serving 2½″ × 2″ × 1″ or 1 muffin	...	156	2.4	2.9
62. Corn flakes, prepared cereal, enriched	1 C	30	108		2.4
63. Corn meal, white and yellow					
Whole					
Enriched[11]	1 T raw	10	36		0.9
	⅔ C cooked (1 oz dry weight)	30	108		2.7
	½ C raw	75	270		6.8
Unenriched	1 T raw	10	36		0.9
	⅔ C cooked (1 oz dry weight)	30	108		2.7
	½ C raw	75	270		6.8
Degerminated meal, grits, and hominy grits					
Enriched[14]	1 T raw	10	36		0.7
	⅔ C cooked (1 oz dry weight)	30	108		2.2
	½ C raw	75	270		5.6

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
2.0	3.9	34	32	0.3	140	.04	.06	0.2	21
3.1	2.7	33	24	0.2	(156)	.03	.04	0.1	21
0.6	7.2	249	58	1.6	6,870	.15	(.16)	(0.6)	50
0.6	7.2	249	58	1.6	6,870	.22	(.20)	(0.8)	100
1.3	7.5	(2)	(6)	(0.1)	(0)	(Trace)	(Trace)	(Trace)	0
0.5	16.1	4	51	0.5	200[13]	.02	.05	0.8	5
1.2	20.5	9	120	0.5	390[13]	.10	.11	1.1	6
1.2	20.5	9	120	0.5	390[13]	.15	.14	1.4	12
4.2	24.7	(81)	119	1.1	86	.16	(.18)	1.1	(Trace)
4.2	24.7	(58)	119	1.0	86	.14	(.14)	0.7	(Trace)
0.2	24.1	(3)	17	(0.3)	(0)	(.05)	.02	0.5	0
0.4	7.4	11	26	0.3	(0)[15]	.04	.03	0.4	0
1.1	22.2	33	78	0.9	(0)[15]	.13	.08	1.1	0
2.8	55.5	82	182	2.2	(0)[15]	.33	.20	2.6	0
0.4	7.4	2	26	0.2	(0)[15]	.03	.01	0.2	0
1.1	22.2	5	78	0.7	(0)[15]	.09	.03	0.5	0
2.8	55.5	14	182	1.8	(0)[15]	.25	.08	1.3	0
0.1	7.9	11	14	0.3	(0)[15]	.04	.03	0.4	0
0.3	23.7	33	42	0.9	(0)[15]	.13	.08	1.1	0
0.8	59.2	82	98	2.2	(0)[15]	.33	.20	2.6	0

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
Unenriched	1 T raw	10	36		0.7
	2/3 C cooked (1 oz dry weight)	30	108		2.2
	1/2 C raw, dry	75	270		5.6
64. Corn pone[1]	1	...	305		6.8
65. Cornstarch	1 T	10	35		Trace
66. Cornstarch pudding[1]	1/2 C	...	184	4.3	Trace
67. Cracker meal	1/2 C	50	211		4.8
68. Crackers, soda, assorted	1 cracker	5	21		0.5
69. Cranberry sauce, canned	1/4 C	60	125		0.1
70. Cream, 20% sweet or sour	1/2 C	120	250	3.5	
71. Cream puff with custard filling	1 medium	120	268		(3.4)
72. Cucumbers					
Cooked	1 medium	100	14		0.7
Raw	1/2 medium peeled or 8 slices	50	7		0.4
73. Custard cream pie (1 crust 9″ dia.)	1/6	...	357		(4.5)
74. Custard cup[1]	1/2 C	...	147	6.1	(0)
75. Dandelion greens					
Cooked	1/2 C	100	52		2.7
Raw	1/2 C	100	52		2.7
76. Doughnuts[1]	1 of 2 1/2″ dia.	...	148	0.7	1.9
77. Eggplant					
Cooked	2/3 C diced	55	15		0.6
Raw	2/3 C diced	55	15		0.6

Fat	Carbo-hydrate	Calcium	Phos-phorus	Iron	Vita-min A	Thi-amine	Ribo-flavin	Niacin	Ascor-bic acid
(gm)	(gm)	(mg)	(mg)	(mg)	(I.U.)	(mg)	(mg)	(mg)	(mg)
0.1	7.9	1	14	0.2	(0)[15]	.01	...	0.1	0
0.3	23.7	3	42	0.5	(0)[15]	.03	.01	0.3	0
0.8	59.2	8	98	1.2	(0)[15]	.08	.03	0.7	0
6.3	55.4	14	186	2.0	(0)	.31	.09	1.3	0
Trace	8.7	Trace	Trace	Trace	(0)	(0)	(0)	(0)	0
4.8	30.9	144	114	0.1	(196)	.05	.21	0.1	1
5.2	36.4	11	51	0.8	(0)	(.04)	(0)	(0.3)	0
0.5	3.6	1	5	0.1	(0)	(Trace)	(0)	(Trace)	0
0.2	30.8	(5)	(4)	(0.2)	(18)	...	(.02)	...	1
24.0	4.8	(116)	(92)	(.07)	(996)	(.04)	(.17)	(0.1)	(1)
(11.8)	(37.2)	24	(46)	0.6	(0)	.04	.10	0.2	(0)
0.1	2.7	10	21	0.3	0[16]	.03	.07	0.2	4
Trace	1.4	5	10	0.2	0[16]	.02	.04	0.1	4
(15.8)	(49.6)	32	(61)	0.8	(0)	.05	.13	0.3	(0)
6.3	16.4	134	138	0.6	388	.06	.24	0.1	1
0.7	8.8	187	70	3.1	13,650	.13	.11	(0.6)	18
0.7	8.8	187	70	3.1	13,650	.19	.14	(0.8)	36
6.3	20.2	14	30	(0.6)	78	.08	.07	0.6	Trace
0.1	3.0	8	20	0.2	20	.03	.02	0.3	2
0.1	3.0	8	20	0.2	20	.04	.03	0.4	3

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
78. Eggs					
Whole, fresh, edible portion	1 medium egg	45	71	5.8	
Egg white	1	30	14	3.2	
Egg yolk	1	15	53	2.4	
Fried[1]	1 medium egg	...	112	5.8	
Scrambled egg or omelet[1]	1 medium egg	...	118	6.3	
Whole dried	1 T	5	30	(2.4)	
	1 C	80	474	(38.6)	
79. Fig bars	1 bar	15	54		0.6
80. Figs					
Dried	5 medium	100	300		4.0
Fresh	4 large	100	88		1.4
81. Fish					
Class I (medium fat fish) cooked: black sea bass, bluefish, catfish, halibut, herring, pike	1 medium serving	100	98	19.0	
Class II (low fat, low protein) cooked: cod, haddock	1 medium serving	100	70	16.5	
Class III (high fat, high protein)					
Salmon					
Canned	1/3 C	50	84	10.3	
Fresh, steamed	1 piece 2″ × 3″ × 3/4″	50	84	10.3	
Sardines, canned (drained solids)	5 sardines 3″ long	50	104	12.8	
Tuna, canned	1/3 C	50	147	12.0	
82. Flour					
Buckwheat, light	1 T	8	28		0.5
	1/2 C	65	230		4.1
Rye, light	1 T	8	29		0.7
	1/2 C	65	233		5.8
Rye, whole-grain	1 T	8	29		0.9
	1/2 C	65	235		7.3
Wheat, patent	1 T	8	28		0.9
	1/2 C	65	231		7.0

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
5.2	0.3	24	94	1.2	513	.05	.15	Trace	0
0	0.2	2	5	Trace	0	0	.08	Trace	0
4.8	0.1	22	88	1.1	482	.05	.08	...	0
9.7	0.3	25	95	1.2	678	.05	.15	Trace	0
9.8	1.0	43	109	1.2	702	.06	.18	Trace	Trace
(2.2)	(0.1)	9	40	0.4	223	.02	.06	Trace	0
(34.6)	(2.1)	150	640	7.0	3,568	.28	.98	0.2	0
0.7	11.4	(10)	(10)	(0.2)	(0)	(Trace)	(.01)	(0.1)	0
1.2	68.4	...	...	...	110	.30	...	...	...
0.4	19.6	...	...	...	...	.06	...	...	2
2.5	0	21	218	1.0	...	.05	.07	4.2	(2)
0.4	0	18	189	0.9	...	.03	.05	2.3	2
4.8	0	34	143	0.6	40[17]	.02	.09	3.2	0
4.8	0	34	143	0.6	40[17]	.01	.09	3.2	0
5.5	0.6	18	182	0.9	145	.03	.06	2.6	0
11.0	0	15	126	0.8	65	.02	.06	4.6	0
0.1	6.4	1	7	0.1	(0)	.02[18]	.01[18]	0.2[18]	0
0.7	51.8	7	57	0.6	(0)	.20[18]	.05[18]	1.4[18]	0
0.1	6.3	1	22	0.1	(0)	.01	Trace	0.1	0
0.6	51.0	12	181	0.8	(0)	.10	.05	0.6	0
0.1	6.0	5	30	0.4	(0)	.04	.02	0.1	0
1.1	48.9	40	240	3.1	(0)	.31	.14	1.1	0
0.1	6.1	2	7	0.1	(0)	.01	Trace	0.1	0
0.6	49.3	12	60	0.5	(0)	.05	.02	0.5	0

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
Wheat, patent, enriched	1 T	8	28		0.9
	1/2 C	65	231		7.0
Whole-wheat	1 T	8	29		1.0
	1/2 C	65	234		8.4
83. Frankfurter	1 small 5 1/2″ long 3/4″ dia.	60	121	9.1	
84. Frankfurter and roll,[1] commercial	1	...	212	6.8	3.3
85. French dressing	1 T	14	59		0.1
86. French rolls, enriched	1 roll	35	106		2.9
87. French toast[1]	1 slice 3″ × 3″ × 1/2″	...	106	1.2	1.7
88. Fruit cocktail	5/12 C (1/2 C scant)	100	78		(0.4)
89. Gelatin	1 T	8	27	6.8	
90. Gingerbread[1]	1 serving 1″ × 2″ × 2″	...	108	Trace	1.6
91. Graham crackers	1 cracker	10	42		0.8
92. Grapefruit, fresh	1/2 medium, edible portion	100	44		0.5
93. Grapefruit juice					
Canned	5/12 C (1/2 C scant)	100	41		0.5
Fresh	5/12 C (1/2 C scant)	100	44		0.5
94. Grapefruit segments					
Canned	5/12 C (1/2 C scant)	100	81		0.6
Fresh	5/12 C (1/2 C scant)	100	44		0.5
95. Grape juice	1/2 C	100	74		0.4
96. Grapes	24 grapes	100	74		0.8
97. Gravy[1]					
With milk	1 T	...	30	0.5	0.1
With water	1 T	...	19		0.1

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
0.1	6.1	2	7	(0.2)	(0)	(.04)	(.02)	(0.3)	0
0.6	49.3	12	60	(1.9)	(0)	(.29)	(.17)	(2.3)	0
0.2	5.8	3	31	0.3	(0)	.04	.01	0.4	0
1.3	47.1	25	250	2.5	(0)	.36	.08	3.6	0
8.5	2.0	5	98	1.4	(0)	.11	.14	1.4	0
8.7	23.1	(26)	114	1.7	(0)	(.19)	.16	2.0	0
5.5	2.4	(1)	(1)	Trace	0	0	0	0	0
2.1	18.9	(20)	(35)	(0.6)	(0)	(.08)	(.05)	(0.8)	0
5.4	11.5	38	48	0.5	229	.06	.08	(0.5)	Trace
(0.2)	(18.6)	(9)	(12)	(0.4)	160	.01	.01	0.4	2
0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
2.4	19.9	42	22	1.4	92	.08	(.06)	0.9	0
1.0	7.4	2	20	0.2	(0)	.03	.01	0.2	0
0.2	10.1	17	18	0.3	Trace	.04	.02	0.2	40
0.2	9.4	8	12	0.4	Trace	.03	.02	0.2	35
0.2	10.1	17	18	0.3	Trace	.04	.02	0.2	40
0.2	19.1	13	14	0.3	Trace	.03	.02	0.2	30
0.2	10.1	17	18	0.3	Trace	.04	.02	0.2	40
0	18.2	...	...	...	...	.03	.08	...	6
0.4	16.7	17	21	0.6	80	.05	.03	0.4	4
2.4	1.5	18	15	Trace	(24)	.01	.03	Trace	Trace
1.8	0.8	Trace	1	Trace	(0)	(Trace)	(Trace)	(Trace)	0

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
98. Griddle cakes[1]	1 cake 4½″ dia.	...	94	1.6	2.0
99. Hamburger and bun,[1] commercial	1	...	228	8.2	3.3
100. Heart, beef					
Cooked	2 slices 3½″ × 4″ × 3/16″	75	94	(12.4)	
Raw	2 slices 3½″ × 4″ × 3/16″	75	94	(12.4)	
101. Honey	1 T	20	64		0.1
102. Ice cream, plain	1 block 3″ × 3″ × ¾″	60	126	2.4	
	½ C	70	147	2.8	
	1 Dixie cup	60	126	2.4	
	½ pt	140	294	5.6	
	1 scoop 2½″ dia.	50	105	2.0	
103. Jams, marmalades, jellies	1 T (level) or 1 t (heaping)	20	58		0.1
104. Kale					
Cooked	½ C	100	50		3.9
Raw	½ C	100	50		3.9
105. Kola beverages, carbonated	3½ oz	100	48		0
	6 oz bottle	180	86		0
106. Lamb					
Cooked (all methods and all cuts)	3½ oz	100	290	15.6	
Leg roast	1 slice 3½″ × 4½″ × ¼″				
Shoulder roast	4 slices 2½″ × 2″ × ¼″				
Sirloin chops	2 medium 2″ × 1½″ × ¾″				
Stew with vegetables[1]	1 C	...	228	7.0	2.6
107. Lard, bacon fat, suet	1 T	14	126	0	
108. Lemonade[1]	1 C	...	92		0.2
109. Lemon jelly[1]	½ C	...	57	0.8	0.1

Fat	Carbo-hydrate	Calcium	Phos-phorus	Iron	Vita-min A	Thi-amine	Ribo-flavin	Niacin	Ascor-bic acid
(gm)	(gm)	(mg)	(mg)	(mg)	(I.U.)	(mg)	(mg)	(mg)	(mg)
1.4	16.8	(47)	(57)	(0.6)	70	(.10)	(.12)	(0.7)	Trace
10.5	21.6	(27)	128	1.9	(0)	(.13)	.12	2.9	0
(4.7)	(0.5)	8	177	4.6	(0)	.22	.61	4.5	5
(4.7)	(0.5)	8	177	4.6	(0)	.40	.68	5.1	10
0	15.9	1	3	0.2	(0)	Trace	Trace	Trace	1
7.4	12.5	79	62	.06	324	.02	.11	0.1	Trace
8.6	14.6	92	73	.07	378	.03	.13	0.1	Trace
7.4	12.5	79	62	.06	324	.02	.11	0.1	Trace
17.2	29.1	185	146	.14	756	.06	.27	0.1	Trace
6.2	10.4	66	52	.05	270	.02	.10	Trace	Trace
0.1	14.2	2	2	(0.1)	2	Trace	Trace	Trace	1
0.6	7.2	225	62	2.2	7,540	.08	.28	(0.6)	58
0.6	7.2	225	62	2.2	7,540	.12	.35	(0.8)	115
0	12.0	0	0	0	0	0	0	0	0
0	21.6	0	0	0	0	0	0	0	0
25.3	0	9	168	2.3	(0)	.11	.21	4.6	0
11.6	21.2	32	136	2.0	1,822	.14	.15	3.0	9
14.0	0	0	0	0	0	(0)	(0)	(0)	0
0.2	22.1	(4)	(4)	Trace	(0)	Trace	Trace	Trace	14
0.1	13.3	1	1	Trace	(0)	Trace	Trace	Trace	4

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
110. Lemon juice, fresh	1 T	15	7		0.1
	1 C	226	99		2.0
111. Lemon meringue pie (1 crust 9″ dia.)	1/6	...	357		(4.5)
112. Lettuce					
Head	1/5 head	50	9		0.6
Leaf	1 large or 2 small leaves	10	2		0.1
113. Lime juice, fresh	1 T	15	8		0.1
	1 C	240	127		1.9
114. Liver					
Cooked	2 slices 3″ × 2 1/2″ × 3/8″	90	118	(17.8)	
Raw	2 slices 3″ × 2 1/2″ × 3/8″	90	118	(17.8)	
115. Liver sausage	1 slice 3″ dia. 1/4″ thick	30	77	5.0	
116. Loganberries	3/4 C	100	65		1.2
117. Luncheon meat (cold cuts)	1 slice 4″ × 3 1/2″ × 1/8″	30	81	4.6	
118. Macaroni	1/4 C of 1″ pieces dry or 3/4 C cooked	30	108		3.9
119. Macaroni and cheese[1]	1/2 C	...	73	2.4	0.6
120. Margarine	1 T	14	103		0.1
121. Mayonnaise	1 T	14	101	0.2	
122. Meat stock	1 C	170	26	4.1	
123. Milk					
Condensed, sweetened	1 T	20	65	1.6	
Dry					
Malted	1 T	9	38	1.3	
Skim (spray process)	1 T	9	32	3.2	
Whole	1 T	8	40	2.1	

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
0.1	1.3	(2)	(2)	(Trace)	0	Trace	Trace	Trace	7
1.4	19.7	(32)	(23)	(0.2)	0	.09	Trace	0.2	102
(15.8)	(49.6)	32	(61)	0.8	(0)	.05	.13	0.3	(0)
0.1	1.4	11	12	0.2	270	.03	.04	0.1	4
Trace	0.3	6	2	0.1	162	.01	.01	Trace	2
Trace	1.8	(2)	(2)	(Trace)	0	(Trace)	(Trace)	(Trace)	4
0.2	29.5	(34)	(24)	(0.2)	0	(.10)	(Trace)	(0.2)	65
(3.8)	(3.2)	7	336	10.9	17,280	.17	2.14	11.6	14
(3.8)	(3.2)	7	336	10.9	17,280	.24	2.52	14.5	28
6.2	0.4	3	71	1.6	(1,725)	.05	3.40	1.4	(0)
0.8	13.2	36	34	0.9	320	.03	(.07)	(0.3)	23
6.8	0.5	6	51	0.4	(0)	.09	.06	0.8	0
0.4	22.2	7	43	0.4	(0)	.04	.02	0.6	0
4.6	4.9	89	70	0.1	213	.02	.08	0.1	Trace
11.3	0.1	(Trace)	(2)	(Trace)	(277)[19]	(0)	(0)	(0)	0
10.9	0.4	(3)	(8)	(0.1)	(29)	(.01)	(.01)	(0)	(0)
0	2.4	...	...	...	(0)	...	...	...	(0)
1.7	11.0	55	46	(.04)	(86)	(.01)	(.08)	(Trace)	(Trace)
0.8	6.4	32	31	.20	27	.03	.04	...	0
0.1	4.7	117	93	.05	(4)	.03	.18	0.1	1
2.1	3.0	76	58	.05	112	.02	.12	0.1	Trace

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
Evaporated,	1 T	15	21	1.0	
unsweetened	½ C	130	181	9.1	
	1 C	255	354	17.8	
Fresh					
Chocolate flavored	1 C	245	184	7.8	
Skim	1 C	245	86	8.6	
Whole	1 C	245	169	8.6	
124. Mince pie[1] (2 crusts 9″ dia.)	⅙	...	685	10.0	3.7
125. Molasses, cane	1 T	20	48		(0)
	1 C	285	684		(0)
126. Mustard greens					
Cooked	½ C	100	28		2.3
Raw	½ C	100	28		2.3
127. Noodles, egg	¾ C cooked (1 oz dry weight)	30	116		4.3
128. Oatmeal cookies[1]	1 cooky	...	109	0.4	2.3
129. Oats cereals					
Whole-grain	⅔ C cooked (1 oz dry weight)	30	119		4.3
Prepared enriched	1 C	30	110		4.5
130. Oil, salad or cooking	1 T	14	126	0	
131. Okra					
Cooked	½ C	50	20		0.9
Raw	½ C	50	20		0.9
132. Olives, green	6	45	65		0.7
133. Omelet, egg[1]	1 medium egg	...	118	6.3	
134. Onions, green	1 of ½″ dia. 5¼″ long	10	5		0.1
135. Onions, mature					
Cooked	½ C	100	49		1.4
Raw	½ C	100	49		1.4

Fat	Carbo-hydrate	Calcium	Phos-phorus	Iron	Vita-min A	Thi-amine	Ribo-flavin	Niacin	Ascor-bic acid
(gm)	(gm)	(mg)	(mg)	(mg)	(I.U.)	(mg)	(mg)	(mg)	(mg)
1.2	1.5	36	29	.03	60	.01	.05	Trace	Trace
10.3	12.9	316	254	.22	520	.06	.47	0.3	1
20.1	25.2	620	497	.43	1,020	.13	.92	0.5	3
5.4	26.0	267	223	.17	220	.07	.39	0.2	0
0.2	12.5	(289)	(228)	(.17)	(Trace)	.10	(.44)	(0.2)	(2)
9.6	12.0	289	228	.17	(392)	.10	.42	0.2	2
33.6	81.8	40	165	3.4	38	(.20)	.17	3.6	2
(0)	(12.0)	55	10	1.3	(0)	.02	.03	0.6	(0)
(0)	(171.0)	778	145	19.1	(0)	.23	.46	8.0	(0)
0.3	4.0	220	38	2.9	6,460	.06	.16	0.6	51
0.3	4.0	220	38	2.9	6,460	.09	.20	0.8	102
1.5	21.2	7	47	0.6	(60)	(.04)	(.04)	(0.6)	0
3.0	17.8	16	43	0.5	23	.04	.03	0.7	(Trace)
2.2	20.5	16	110	1.6	(0)	.16	.04	0.3	0
2.0	19.0	45	100	1.2	(0)	.22	.04	0.5	0
14.0	Trace	(Trace)	(Trace)	(Trace)	(Trace)	(Trace)	(Trace)	(0)	(0)
0.1	3.7	41	31	0.4	370	.04	.04	0.3	8
0.1	3.7	41	31	0.4	370	.06	.05	0.4	15
6.1	1.8	45	7	0.9	189	Trace	...	...	....
9.8	1.0	43	109	1.2	702	.06	.18	Trace	Trace
Trace	1.1	3	4	0.1	500	Trace	.01	Trace	4
0.2	10.3	32	44	0.5	50	.02	.02	0.1	4
0.2	10.3	32	44	0.5	50	.03	.02	0.1	9

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
136. Orange juice					
Canned	5/12 C (1/2 C scant)	100	55		0.6
Fresh	5/12 C (1/2 C scant)	100	50		0.9
137. Oranges	1 medium, edible portion	100	50		0.9
138. Oysters, liquid and solids					
Cooked (high fat, high protein)	5 medium or 1/2 C solids	125	62	7.5	
Raw (high fat, high protein)	5 medium or 1/2 C solids	125	62	7.5	
139. Pancakes[1]	1 cake 4 1/2" dia.	...	94	1.6	2.0
140. Parker House rolls, enriched	1 roll	30	91		2.5
141. Parsnips					
Cooked	1/2 C	80	66		1.2
Raw	1/2 C	80	66		1.2
142. Pastry, plain[1] (2 pie crusts 9" dia.)	1/6	...	227		3.1
143. Peach pie[1] (2 crusts 9" dia.)	1/6	...	330		3.4
144. Peaches					
Canned	2 halves with 1 T juice	100	75		0.4
Dried	4 medium halves	32	94		1.0
Fresh	1 large, edible portion	100	51		0.5
145. Peanut butter	1 T	15	93		3.9
146. Peanuts, roasted	1 1/2 T chopped or 15 kernels	15	90		4.0
	1 5-cent package	35	210		9.4
147. Pears					
Canned	2 halves with 1 T juice	100	75		0.2
Fresh	1 medium, edible portion	100	70		0.7

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
0.1	12.9	(33)	(23)	(0.4)	(100)	.07	.02	0.2	42
0.2	11.2	33	23	0.4	(190)	.08	.03	0.2	49
0.2	11.2	33	23	0.4	(190)	.08	.03	0.2	49
1.5	4.6	85	215	8.9	...	.15	.29	1.5	...
1.5	4.6	85	215	8.9	...	.22	.29	1.5	...
1.4	16.8	(47)	(57)	(0.6)	70	(.10)	(.12)	(0.7)	Trace
1.8	16.2	(17)	(30)	(0.5)	(0)	(.07)	(.04)	(0.7)	0
0.4	14.6	46	64	0.6	0	.06	.06	0.2	7
0.4	14.6	46	64	0.6	0	.09	.07	0.2	14
14.2	21.5	5	26	(0.8)	0	(.12)	(.07)	(1.0)	0
14.4	46.8	10	39	(1.2)	420	(.14)	(.09)	(1.6)	4
0.1	18.2	(5)	(14)	(0.4)	450	.01	.02	0.7	4
0.2	22.2	14	40	2.2	1,040	Trace	.06	1.7	6
0.1	12.0	8	22	0.6	880	.02	.05	0.9	8
7.2	3.2	11	59	0.3	0	.03	.02	2.4	(0)
6.6	3.5	11	59	0.3	0	.04[20]	.02	2.4	(0)
15.5	8.3	26	138	0.7	...	.10[20]	.06	5.7	(0)
0.1	18.4	(8)	(10)	(0.2)	Trace	.01	.02	0.1	2
0.4	15.8	13	16	0.3	20	.02	.04	0.1	4

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
148. Peas					
Canned, green	½ C	100	69		3.4
Dried: black-eyed peas, chick-peas, cowpeas, split peas	½ C cooked	100	117		5.7
Fresh, green					
Cooked	½ C	80	81		5.4
Raw	½ C	80	81		5.4
149. Pecans	12 meats, or halves	15	112		1.4
150. Peppers, green					
Cooked	½ large	50	14		0.6
Raw	½ large	50	14		0.6
151. Pickles, cucumber, sweet	1 small	30	3		0.2
152. Pineapple					
Canned	2 slices ⅜″ thick	100	87		0.4
Fresh	2 slices ⅜″ thick or ½ C cubes	100	58		0.4
153. Pineapple juice, canned	5/12 C (½ C scant)	100	54		0.3
154. Plums (Italian prunes)					
Canned	2 medium with 1–2 T juice	100	84		0.4
Fresh	2	70	39		0.5
155. Pork					
Fresh (medium fat), cooked (all methods and all cuts)	3½ oz	100	352	14.5	
Chops	1 medium ½″ thick				
Ham, lean	1 slice 5″ × 5″ × ¼″				
Loin, roasted	1 piece 3¼″ × 3″ × ⅓″				
Picnic ham	1 slice 4½″ × 3½″ × ⅓″				
Salt pork (fat), cooked	1 piece 1″ × 2″ × 1″	35	273	1.4	
Sausage links, cooked (broiled or fried)	3 links 3″ long ½″ dia.	60	268	6.5	

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
0.4	12.9	25	67	1.8	540	.11	.06	0.9	8
2.0	19.0	(49)	(154)	(3.4)	(0)	.05	.05	0.8	(0)
0.3	14.2	18	98	1.5	544	.20	.11	1.4	10
0.3	14.2	18	98	1.5	544	.29	.14	1.7	21
11.0	2.0	11	49	0.4	8	.11	.02	0.1	Trace
0.1	2.8	6	12	0.2	315	.03	.02	0.2	30
0.1	2.8	6	12	0.2	315	.04	.02	0.2	60
0.1	0.6	7	7	0.3	57	Trace	.01	Trace	2
0.1	21.1	29	7	0.6	80	.07	.02	0.2	9
0.2	13.7	16	11	0.3	130	.08	(.02)	(0.2)	24
0.1	13.0	15	8	0.5	80	.05	.02	0.2	9
0.1	20.4	8	12	1.1	(230)	.03	.03	0.4	1
0.1	9.0	12	14	0.4	245	.10	(.02)	0.4	4
32.7	0	8	156	2.2	(0)	.60	.16	3.5	0
29.8	0	1	15	0.2	(0)	(.06)	(.01)	(0.3)	0
26.9	0	4	70	1.0	(0)	.08	.08	1.3	0

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TABLE 10 (Continued)

Food item	Household measure	Weight	Food energy	Protein	
				Animal	Vegetable
		(gm)	(cal)	(gm)	(gm)
Sausage patties, cooked (all methods)	1 pat 2″ dia. ½″ thick	60	268	6.5	
Smoked					
Bacon, fried crisp	1 slice thin 5″ long	15	30	1.4	
Bacon (medium fat), raw	1 strip 1¼″ × 9″ × ⅛″	15	94	1.4	
Canadian bacon, cooked (all methods)	1 slice 2¼″ dia. 3/16″ thick	30	115	5.1	
Ham, cooked (all methods)	1 slice 4½″ × 4″ × ⅜″	100	384	16.9	
Spareribs, cooked (all methods)	5 pieces 4″ × 1″	120	415	17.5	
156. Potato chips	10 large pieces	15	80	1.0	
157. Potato salad[1]	½ C	...	258	2.7	1.7
158. Potatoes					
Cooked					
Baked	1 medium	150	128		3.0
Boiled	1 small or ½ C cubed	100	85		2.0
French fried[1]	10 pieces 2¼″ × ½″ × ½″	...	265		2.0
Mashed[1]	½ C	...	144	0.5	2.1
Pan fried[1]	½ C	...	265		2.0
Scalloped[1]	½ C	...	171	2.2	2.5
Raw	1 small or ½ C cubed	100	85		2.0
	1 medium	150	128		3.0
159. Prune whip[1]	½ C	...	198	3.7	0.4
160. Prunes, dried	4 medium	33	99		0.8
161. Pumpkin					
Canned	½ C	100	38		1.0
Fresh, cooked	½ C	100	36		1.2
162. Pumpkin pie[1] (1 crust 9″ dia.)	⅙	...	271	2.4	2.0
163. Radishes	5 medium	50	11		0.6

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
26.9	0	4	70	1.0	(0)	.08	.08	1.3	0
2.7	0	0	16	0.1	(0)	(.06)	(.01)	(0.3)	0
9.8	(0.2)	2	16	0.1	(0)	(.06)	(.02)	(0.3)	0
10.5	(0.1)	3	55	0.8	(0)	.15	.05	1.0	0
35.0	(0.3)	10	182	2.5	(0)	.50	.17	3.4	0
38.4	0	10	188	2.6	(0)	.72	.20	4.2	0
5.6	7.4	4	21	0.3	8	.03	.02	0.4	3
19.3	16.8	25	99	1.3	271	.09	.09	0.8	7
0.2	28.6	16	84	1.0	30	.11	.05	1.4	13
0.1	19.1	11	56	0.7	20	.08	.03	1.0	8
20.1	19.1	11	56	0.7	20	.08	.03	1.0	8
5.4	21.0	26	72	0.7	238	.08	.05	1.0	9
20.1	19.1	11	56	0.7	20	.08	.03	1.0	8
5.4	26.0	85	122	0.8	236	.11	.14	1.2	10
0.1	19.1	11	56	0.7	20	.11	.04	1.2	17
0.2	28.6	16	84	1.0	30	.16	.06	1.8	26
7.3	28.9	44	148	2.4	1,091	.09	.15	0.3	1
0.2	23.4	18	28	1.3	624	.03	.05	0.6	1
0.3	7.9	(20)	(36)	(0.7)	3,400	.02	.06	0.5	(0)
0.2	7.3	21	44	0.8	(3,400)	(.04)	(.06)	(0.5)	4
9.8	41.4	85	92	1.6	1,851	(.10)	.17	0.9	Trace
Trace	2.1	18	16	0.5	15	.02	.02	Trace	12

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TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
164. Raisins, dried	1 T	8	24		0.2
	1/3 C	45	134		1.0
165. Rennet dessert[1]	1/4 C	...	55	2.2	(0)
166. Rhubarb, cooked	1/2 C	100	18		0.5
167. Rhubarb pie[1] (2 crusts 9″ dia.)	1/6	...	364		3.7
168. Rice					
Brown, unenriched	3/4 C cooked (1 oz dry weight)	30	107		2.2
White, unenriched	3/4 C cooked (1 oz dry weight)	30	105		2.3
169. Rice cereals, prepared enriched	1 C	30	106		1.8
170. Rice pudding, creamy[1]	1/2 C	...	185	6.7	1.0
171. Rutabagas, fresh					
Cooked	1/2 C cubed	100	41		1.1
Raw	1/2 C cubed	100	41		1.1
172. Salad dressing, boiled[1]	1 T	...	27	0.6	Trace
173. Salmon croquette[1]	1/2 C	...	238	12.8	1.4
174. Salmon loaf[1]	1/2 C	...	158	12.9	1.2
175. Sauerkraut, canned	2/3 C	100	20		1.1
176. Scrambled egg[1]	1 medium egg	...	118	6.3	
177. Shrimp, canned	1 C	100	82	17.8	
178. Sirup (table blends)	1 T	20	59		(0)
179. Soups					
Bean[1]	1 C	...	64	1.3	1.6
Potato[1]	1 C	...	211	5.7	2.1

Fat	Carbo-hydrate	Calcium	Phos-phorus	Iron	Vita-min A	Thi-amine	Ribo-flavin	Niacin	Ascor-bic acid
(gm)	(gm)	(mg)	(mg)	(mg)	(I.U.)	(mg)	(mg)	(mg)	(mg)
Trace	5.7	6	10	0.3	4	.01	.01	Trace	Trace
0.2	32.0	35	58	1.5	22	.07	.04	0.2	Trace
2.4	6.2	72	57	.04	(98)	.02	.10	Trace	Trace
0.1	3.8	21	25	0.5	30	.01	...	0.1	4
14.4	55.1	6	45	(1.2)	20	(.14)	(.07)	(1.1)	3
0.5	23.3	12	91	1.6	(0)	.09	.02	1.4	0
0.1	23.8	3	28	0.2	(0)	.02	.01	0.4	0
0.4	24.0	8	45	0.6	(0)	.09	.02	1.2	0
6.7	23.5	113	151	0.9	473	.07	.25	0.3	1
0.1	8.9	55	41	0.4	330	.04	.05	0.4	18
0.1	8.9	55	41	0.4	330	.06	.06	0.5	36
1.9	1.8	15	20	0.1	108	.01	.03	Trace	Trace
15.0	11.4	92	212	1.2	499	(.09)	.22	3.7	1
7.6	8.3	73	207	1.3	243	.07	.19	3.6	1
0.2	3.4	46	31	(0.5)	Trace	.03	.20	0.2	18[22]
9.8	1.0	43	109	1.2	702	.06	.18	Trace	Trace
0.8	0.8	(75)	(210)	(2.0)	60	.01	.03	1.9	0
(0)	(15.0)	9	3	0.8	0	0	Trace	Trace	(0)
3.2	6.1	17	58	1.1	6	.05	.03	0.4	Trace
7.7	27.6	205	210	0.8	(335)	.14	.31	1.1	10

(Continued on next page)

TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
Split pea[1]	1 C	...	102		2.4
Tomato, clear[1]	1 C	...	104	Trace	1.7
Tomato, creamed[1]	1 C	...	269	6.3	1.5
Vegetable[1]	1 C	...	150	5.5	3.0
180. Soybeans, mature, whole	1/2 C	85	298		29.7
181. Soy flour, soy flakes, soy grits					
Low fat	1/3 C	30	74		13.4
Medium fat	1/3 C	30	85		12.8
Full fat	1/3 C	30	112		10.8
182. Soy sauce	1/2 C	100	49		2.0
183. Spaghetti	1/4 C of 1" pieces dry or 3/4 C cooked	30	108		3.9
184. Spinach					
Canned	1/2 C	100	25		2.3
Fresh					
Cooked	1/2 C	100	25		2.3
Raw	1 C	100	25		2.3
185. Squash					
Summer					
Cooked	1/2 C	100	19		0.6
Raw	1/2 C	100	19		0.6
Winter					
Cooked	1/2 C	100	44		1.5
Raw	1/2 C	100	44		1.5
186. Strawberries, fresh	12 hulled or 1/2 C	100	41		0.8
187. Sugar					
Brown	1 T	11	42		(0)
	1 C	180	688		(0)
Granulated	1 t	4	16		(0)
	1 T	13	52		(0)
	1 C	200	796		(0)
Powdered	1 T	11	44		(0)

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
6.4	8.5	(20)	63	1.4	(0)	.02	.02	0.4	0
5.9	10.9	10	21	(0.6)	1,281	.08	.04	0.9	16
18.3	18.5	225	197	(0.8)	1,503	.14	.35	0.9	13
0.3	28.3	43	87	1.1	2,031	.10	.06	1.2	14
15.4	(10.2)[23]	193	498	6.8	94	.97	.26	1.8	Trace
0.3	(4.3)[23]	80	187	3.9	21	.33	.10	0.9	(0)
2.0	(4.1)[23]	73	183	3.9	33	.25	.10	0.8	(0)
6.2	(3.4)[23]	58	166	3.6	42	.23	.08	0.7	(0)
1.0	9.0	...	...	...	...	...	.02	...	...
0.4	22.2	7	43	0.4	(0)	.04	.02	0.6	0
0.4	3.0	[24]	33	1.6	6,790	.02	.08	0.3	14
0.3	3.2	[25]	55	3.0	9,420	.08	.19	0.6	30
0.3	3.2	[25]	55	3.0	9,420	.12	.24	0.7	59
0.1	3.9	15	15	0.4	260	.03	.04	0.9	8
0.1	3.9	15	15	0.4	260	.04	.05	1.1	17
0.3	8.8	19	28	0.6	4,950	.04	.06	0.5	4
0.3	8.8	19	28	0.6	4,950	.05	.08	0.6	8
0.6	8.1	28	27	0.8	60	.03	.07	0.3	60
(0)	(10.5)	8[6]	4[6]	0.3	(0)	(0)	(0)	(0)	(0)
(0)	(171.9)	137[6]	67[6]	4.7	(0)	(0)	(0)	(0)	(0)
(0)	4.0	(0)	(0)	Trace	(0)	(0)	(0)	(0)	0
(0)	13.0	(0)	(0)	Trace	(0)	(0)	(0)	(0)	0
(0)	199.0	(0)	(0)	0.2	(0)	(0)	(0)	(0)	0
(0)	11.0	(0)	(0)	Trace	(0)	(0)	(0)	(0)	0

(Continued on next page)

TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
188. Sweetpotatoes					
Cooked					
Baked	1 medium 5″ long 2½″ dia.	160	200		2.9
Boiled	½ C	100	125		1.8
Candied[1]	3 medium slices or ½ medium potato	...	168	Trace	1.4
Raw	1 medium 5″ long 2½″ dia.	160	200		2.9
189. Sweet rolls, unenriched	1 small 4½″ dia.	70	213		5.5
190. Tangerine juice, fresh	½ C	120	60		1.0
191. Tangerines, fresh	1 small	50	25		0.4
192. Tapioca pudding, creamy[1]	½ C	...	128	3.8	0.1
193. Tomato juice, canned	½ C	100	23		1.0
194. Tomato puree, canned	½ C	100	40		1.8
195. Tomato sauce[1]	¼ C	...	80	0.1	1.0
196. Tomatoes					
Canned	½ C	100	21		1.0
Fresh					
Cooked	½ C	100	23		1.0
Raw	1 medium 2½″ dia.	150	34		1.5
	1 slice ¼″ thick	30	7		0.3
197. Tongue					
Cooked	3 slices 2″ × 3″ × ¼″	100	202	16.4	
Raw	3 slices 2″ × 3″ × ¼″	100	202	16.4	
198. Turkey, cooked	1 slice 4″ × 2½″ × ¼″	55	144	11.1	
199. Turnip greens					
Cooked	½ C	100	37		2.9
Raw	½ C	100	37		2.9
200. Turnips, fresh					
Cooked	½ C	100	35		1.1
Raw	½ C	100	35		1.1

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
1.1	44.6	48	78	1.1	12,320[26]	.11	.08	0.9	18
0.7	27.9	30	49	0.7	7,700[26]	.07	.05	0.6	11
4.3	30.6	25	40	0.6	6,314	.06	.04	0.4	9
1.1	44.6	48	78	1.1	12,320[26]	.16	.10	1.1	35
3.8	39.2	(39)	(70)	0.4	(0)	.06	.09	0.6	0
0.4	13.1	(40)	(28)	(0.5)	(504)	.08	(.04)	(0.2)	37
0.2	5.4	(16)	(12)	(0.2)	(210)	.04	(.02)	(0.1)	16
4.1	18.8	101	93	0.3	(216)	.04	.17	0.1	1
0.2	4.3	(7)	(15)	(0.4)	1,050	.05	.03	0.7	16
0.5	7.2	(11)	(37)	(1.1)	1,880	.09	(.07)	1.8	28
5.8	5.8	(7)	(14)	0.3	758	.04	.02	0.5	8
0.2	3.9	(11)	(27)	(0.6)	1,050	.05	.03	0.7	16
0.3	4.0	11	27	0.6	1,100	.04	.03	0.5	12
0.4	6.0	16	40	0.9	1,650	.09	.06	0.9	34
0.1	1.2	3	8	0.2	330	.02	.01	0.2	7
15.0	0.4	30	119	6.9	(0)	.15	.23	4.0	0
15.0	0.4	30	119	6.9	(0)	.22	.27	5.0	0
11.1	0	13	176	2.1	Trace	Trace	.08	1.8	1
0.4	5.4	259	50	2.4	9,540	.07	.45	0.6	68
0.4	5.4	259	50	2.4	9,540	.10	.56	0.8	136
0.2	7.1	40	34	0.5	Trace	.04	.05	0.4	14
0.2	7.1	40	34	0.5	Trace	.06	.06	0.5	28

(Continued on next page)

TABLE 10 (Continued)

Food item	Household measure	Weight (gm)	Food energy (cal)	Protein: Animal (gm)	Protein: Vegetable (gm)
201. Veal					
Cooked (all methods and all cuts)	2 oz	60	110	11.5	
Chops	1 medium				
Cutlet, round	1 medium				
Leg, roast	2 slices 3″ × 3⅜″ × ¼″				
Stew meat (74% lean)	2 pieces 2½″ × 1″ × 1″				
Stew with vegetables[1]	1 C	...	180	8.6	2.6
202. Vegetable salad, combination[1]	¾ C	...	61		0.8
203. Vienna sausage, canned	1 of ¾″ dia. 2″ long	20	42	3.2	
204. Waffles[1]	1 waffle 4½″ dia.	...	94	1.6	2.0
205. Walnuts					
Black	8–10 halves	15	105		2.2
English	12 meats	15	105		2.2
206. Watermelon	½ C cubes or balls	100	31		0.5
	1 slice ¾″ thick 6″ dia.	330	102		1.6
207. Wheat cereals					
Whole-grain	⅔ C cooked (1 oz dry weight)	30	110		3.5
Prepared whole-grain	⅔ C	30	111		3.1
Prepared enriched	1 C	30	106		3.2
Prepared unenriched	1 C	30	112		3.6
Granular enriched	⅔ C cooked (1 oz dry weight)	30	108		3.4
Granular unenriched	⅔ C cooked (1 oz dry weight)	30	108		3.4
208. Wheat germ	1 T	10	39		2.5
209. Yeast, brewer's, dried	1 T	10	35		4.6

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vita-min A (I.U.)	Thi-amine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)
7.2	0	7	124	1.7	(0)	.04	.09	2.1	0
5.6	21.2	33	154	2.2	1,822	.12	.12	2.5	9
4.3	4.8	14	19	Trace	1,207	.04	.04	0.2	17
3.2	0	4	(33)	0.1	(0)	.01	.03	0.6	0
1.4	16.8	(47)	(57)	(0.6)	70	(.10)	(.12)	(0.7)	Trace
9.7	2.3	12	57	0.3	4	.07	.02	0.2	Trace
9.7	2.3	12	57	0.3	4	.07	.02	0.2	Trace
0.2	6.9	7	12	0.2	590	.05	.05	0.2	6
0.7	22.8	23	40	0.7	1,947	.16	.16	0.7	20
0.6	22.7	11	116	1.1	(0)	.14	.04	1.4	0
0.4	23.6	(11)	(116)	(1.1)	(0)	.06	.04	1.3	0
0.2	23.0	13	93	1.6	(0)	.24	.04	1.4	0
0.4	23.3	10	106	1.1	(0)	.04	.04	1.3	0
0.3	22.8	6	38	(0.4)	(0)	(.11)	(.08)	(0.4)	0
0.3	22.8	6	38	0.2	(0)	.02	.02	0.3	0
1.0	5.0	8	110	0.8	(0)	.20	.08	0.5	(0)
0.2	3.7	11	189	1.8	(0)	.97	.54	3.6	(0)

Footnotes to Table 10

[1] Calculated from ingredients.

[2] Based on green products; bleached products contain only a trace.

[3] Contributed by tomatoes.

[4] 118 mg; may not be available because of presence of oxalic acid.

[5] Based on vegetable-extract type; meat-extract type may have up to 27.0 mg of niacin per 100 gm.

[6] Based on dark brown sugar; lower values for light brown sugar.

[7] Year-round average.

[8] Based on deeply colored varieties.

[9] 105 mg; may not be available because of presence of oxalic acid.

[10] Values were not available for chili powder used in this recipe.

[11] 95 mg; may not be available because of presence of oxalic acid.

[12] 160 mg; may not be available because of presence of oxalic acid.

[13] Based on yellow corn; white corn contains only a trace.

[14] Figures for enrichment ingredients are based on minimum standards.

[15] For yellow-corn products, calculate vitamin-A value as 405 I.U. per 100 gm.

[16] Based on pared cucumber; unpared contains about 260 I.U. vitamin A per 100 gm.

[17] Based on pink salmon; canned red salmon may have a value several times higher.

[18] Whole-grain buckwheat flour has approximately .61 mg thiamine, .06 mg riboflavin, and 4.2 mg niacin per 100 gm.

[19] Unfortified margarine is considered to have no vitamin A value.

[20] Based on peanuts without skins; when skins are included, the thiamine value is higher.

[21] 51 mg; may not be available because of presence of oxalic acid.

[22] Drained solids only.

[23] "Available" carbohydrate.

[24] 90 mg; may not be available because of presence of oxalic acid.

[25] 81 mg; may not be available because of presence of oxalic acid.

[26] If only pale varieties were used, value would be very much lower.

TABLE 11
Analysis of Alcoholic Beverages*

Beverage	Approximate measure	Weight (gm)	Food energy (cal)	Alco-hol (gm)	Pro-tein (gm)
Ale	3½ oz	100	43	3.8	0.5
Ale	1 large glass, 8 oz	240	102	9.1	1.2
Ale	1 bottle, 12 oz	340	145	12.9	1.7
Beer, American	3½ oz	100	43	3.7	0.5
Beer, American	1 large glass, 8 oz	240	103	8.9	1.2
Beer, American	1 bottle, 12 oz	340	145	12.6	1.7
Benedictine	1 cordial glass	20	73	6.6	...
Brandy, average	1 jigger, 1½ oz	43	106	15.1	
Cider, fermented	1 glass, 6 oz	180	73	9.4	...
Cider, sweet	1 glass, 6 oz	180	77	0.2	...
Cordials, liqueurs as anisette, crème de menthe	1 cordial glass	20	70	6.0	...
Curaçao	1 cordial glass	20	58	6.0	...
Gin, dry	1 jigger, 1½ oz	43	106	15.1	
Rum	1 jigger, 1½ oz	43	106	15.1	
Whisky, Bourbon, Irish, or Rye	1 jigger, 1½ oz	43	120	17.2	
Whisky, Scotch	1 jigger, 1½ oz	43	106	15.1	
Wine, California, red	3½ oz	100	73	10.0	0.2
Wine, California, white	3½ oz	100	73	10.0	0.2
Wine, Champagne, from California and New York	3½ oz	100	90	11.0	0.2
Wine, port, American	3½ oz	100	162	15.0	0.3
Wine, sauterne	3½ oz	100	90	10.5	0.2
Wine, sherry	3½ oz	100	138	15.0	0.3
Wine, Tokay	3½ oz	100	119	10.0	0.3

Note: Alcohol yields 7.1 calories per gram.

* From Anna DeP. Bowes and Charles F. Church, *Food Values of Portions Commonly Served*, Philadelphia Child Health Society, 1946, pp. 40–41.

Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic acid (mg)
...	3.5	...	...	...	...	Trace	.04	.80	
...	8.4	...	...	...	...	.01	.08	1.92	
...	11.9	...	...	...	...	.01	.12	2.72	
...	3.7	...	...	...	...	Trace	.03	.80	
...	8.9	...	...	...	...	.01	.07	1.92	
...	12.6	...	...	...	...	.01	.10	2.72	
...	6.6								
...	1.8								
...	18.9								
...	7.0								
...	4.0								
...	0.5	9	15	0.3					
...	0.5	9	15	0.3					
...	3.0								
...	14.0								
...	4.0								
...	8.0								
...	12.0								

TABLE 12

Weights and Measures

Weights	*Equivalents*
1 kilogram (kg)	1,000 grams
	2.2 pounds
60 kilograms	132 pounds (average woman)
70 kilograms	154 pounds (average man)
1 pound (lb)	454 grams
	.454 kilogram
1 ounce (oz)	30 grams (28.35 grams actual weight)
1 fluid ounce	30 cubic centimeters (cc)
	30 grams approximately
1 gram (gm)	1,000 milligrams
	.0352 ounce
100 grams	$3\frac{1}{2}$ ounces (3.527 ounces actual weight)
1 milligram (mg)	$\frac{1}{1000}$ gram
	1,000 micrograms
1 microgram (mcg) or gamma	1/millionth gram
	$\frac{1}{1000}$ milligram
1 International Unit (I.U.)	Differs for each vitamin (for vitamin A it is 0.6 microgram)
1 gram carbohydrate	4 calories
1 gram fat	9 calories
1 gram protein	4 calories
1 gram alcohol	7 calories
Measures	
1 teaspoon (t)	60 drops
1 tablespoon (T)	3 teaspoons
1 cup (C)	16 tablespoons
	$\frac{1}{2}$ pint
	240 cubic centimeters
	8 fluid ounces
2 cups	1 pint (pt)
4 cups	1 quart
1 quart (qt)	2 pints
	1 liter (.9464 liter actual volume)
	1,000 cc (946.4 cc actual volume)
	32 ounces
4 quarts	1 gallon (gal)
1 liter (l)	1.06 quarts

APPENDIX B

TABLES OF MEALS AND MEAL ANALYSIS

Table 13: Check List of Food Consumption by Basic Seven Food Groups for One Week

Table 14: The Analysis of a Good Breakfast

Table 15: The Analysis of a Poor Breakfast

Table 16: The Analysis of a School Lunch—Type A

Table 17: The Analysis of an Incomplete Lunch

Table 18: The Analysis of a Balanced Dinner

Table 19: The Analysis of One Complete Day's Diet

Table 20: Percentages of Day's Needs Supplied by Diet in Table 19

APPENDIX B

Tables of Meals and Meal Analysis

Instructions to the person recording his diet. The Nutrition Section of the U.S. Public Health Service offers the following suggestions for recording your diet:

1. Write down everything you eat or drink. If you miss a meal, write "Nothing" in the space for that meal.
2. Tell how food is cooked. If you eat a food raw, write "raw" after it.
3. When you eat two foods together, write down both of them like this:

   1 white roll with jelly
   1 cup black coffee with 1 teaspoon sugar

4. Write down how much you eat of each food. Tell how many teaspoonfuls or tablespoonfuls you eat; tell whether you eat 1/4 or 1/2 or 1 cupful.
5. Be sure to write the kind of food you eat. If you eat a cereal, write "corn flakes," "grits," "oatmeal," or whatever kind of cereal it is. Be sure to tell the *kind* if you eat any of these foods: bread, meat, peas, beans, potatoes, soups, salads, or sandwiches.

Instructions for analyzing the diet. After a single meal or the meals for a whole day or week have been recorded as above indicated, they can be analyzed for their nutritional content.

Two methods of meal analysis are illustrated:

When meals are to be analyzed on the basis of the Basic Seven Food Groups, use Table 13 as a model. The number of servings of foods in each group is checked and compared with the recommended daily minimum. This procedure is simple and gives an approximately accurate answer.

For more accurate information about your diet, the method of meal analysis illustrated in Tables 14 to 20 should be used. The first two tables show the composition of a good and a poor breakfast. The next two tables illustrate the nutritional content of a good and a poor lunch; the good lunch is a School Lunch—Type A. One of the dinners from A Sample Meal Guide for One Week given on pages 382 and 383 is next analyzed. Finally, the nutritive value of a full day's diet is shown. These tables also show the percentages of the day's needs supplied by the meals for individuals of differing age, sex, and degree of physical activity.

TABLE 13

Check List of Food Consumption by Basic Seven Food Groups for One Week

Day	Meals	Groups 1	2	3	4	5	6	7
First day Date:	Breakfast							
	Lunch							
	Dinner							
	Extra							
	Total							
Second day Date:	Breakfast							
	Lunch							
	Dinner							
	Extra							
	Total							
Third day Date:	Breakfast							
	Lunch							
	Dinner							
	Extra							
	Total							
Fourth day Date:	Breakfast							
	Lunch							
	Dinner							
	Extra							
	Total							
Fifth day Date:	Breakfast							
	Lunch							
	Dinner							
	Extra							
	Total							
Sixth day Date:	Breakfast							
	Lunch							
	Dinner							
	Extra							
	Total							
Seventh day Date:	Breakfast							
	Lunch							
	Dinner							
	Extra							
	Total							
Minimum daily serving[1]		1	2	2	4	2	3	3

[1] These are the fewest numbers of servings per day that can be recommended. More servings are a greater health protection. (See Chapter 10 for the classification of foods by groups.)

TABLE 14

The Analysis of a Good Breakfast

Food item	Weight (gm)	Food energy (cal)	Protein (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Milk, fresh whole, 1 large glass	245	169	8.6	289	.17	392	.10	.42	0.2	2
Egg, 1 medium	45	71	5.8	24	1.20	513	.05	.15	Trace	0
Orange, 1 medium	100	50	0.9	33	.40	190	.08	.03	0.2	49
Toast, whole wheat, 2 slices	34	104	3.8	24	1.00	0	.08	.06	1.4	0
Butter, 2 pats	14	102	Trace	2	.02	462	Trace	Trace	Trace	0
Total		496	19.1	372	2.79	1557	.31	.66	1.8	51
Percentage of Day's Needs										
Child: 7–9 years old		25	32	37	28	44	31	44	18	85
Girl: 13–15 years old		19	24	29	19	31	24	33	14	64
Boy: 16–20 years old		13	19	27	19	26	18	26	11	51
Woman: Moderately active		21	32	37	23	31	26	44	15	73
Man: Physically active		17	27	37	23	31	21	37	12	68

Note: Breakfast should supply at least 25 percent of the day's needs. The breakfast meets this requirement for most nutrients for the individuals listed. Where it falls short, as for the boy, larger servings are needed. Other meals should be planned to supplement low and high contributions of this meal in order to meet the Nutrition Yardstick given in Table 3 on page 26.

TABLE 15

The Analysis of a Poor Breakfast

Food item	Weight (gm)	Food energy (cal)	Protein (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Shredded wheat, 1 biscuit	30	111	3.1	11	1.1	0	.06	.04	1.3	0
Milk, skim, for cereal, $1\frac{1}{2}$ C	123	43	4.3	145	.09	Trace	.05	.22	0.1	1
Toast, white, enriched, 1 slice	17	53	1.7	11	0.4	0	.04	.03	0.4	0
Butter, 1 pat	7	51	Trace	1	.01	231	Trace	Trace	Trace	0
Coffee, 1 C	170	0	0	0	0	0	...	...	...	0
Cream, for coffee, 1 T	15	31	0.4	15	.01	124	Trace	Trace	Trace	Trace
Sugar, 1 t for coffee, 2 for cereal	12	48	0	0	Trace	0	0	0	0	0
Total		337	9.5	183	1.61	355	.15	.29	1.8	1
Percentage of Day's Needs										
Child: 7–9 years old		17	16	18	16	10	15	19	18	2
Girl: 13–15 years old		13	12	14	11	7	12	15	14	1
Boy: 16–20 years old		9	10	13	11	6	9	12	11	1
Woman: Moderately active		14	16	18	13	7	12	19	15	1
Man: Physically active		11	14	18	13	7	10	16	12	1

Note: This breakfast does not supply the recommended 25 percent of the day's needs. Needs are based upon the Nutrition Yardstick given in Table 3 on page 26.

TABLE 16

The Analysis of a School Lunch—Type A

Food item	Weight (gm)	Food energy (cal)	Protein (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Milk, whole, 1 large glass	245	169	8.6	289	.17	392	.10	.42	0.2	2
Fish, medium fat, 2 oz	60	59	11.4	13	.60	....	.03	.04	2.5	1
Beans, snap, string, $\frac{3}{4}$ C	150	63	3.6	98	1.65	945	.09	.12	0.8	15
Bread, white, enriched, 2 slices	40	104	3.4	22	.80	0	.10	.06	0.8	0
Butter, 2 t	10	74	Trace	2	.02	330	Trace	Trace	Trace	0
Total		469	27.0	424	3.24	1667	.32	.64	4.3	18
		Percentage of Day's Needs								
Child: 7–9 years old		23	45	42	32	48	32	43	43	30
Girl: 13–15 years old		18	34	33	22	33	25	32	33	23
Boy: 16–20 years old		12	27	30	22	28	19	26	25	18
Woman: Moderately active		20	45	42	27	33	27	43	36	26
Man: Physically active		16	39	42	27	33	21	36	29	24

Note: This lunch meets the five "musts" as listed on page 183 for School Lunch—Type A. It supplies at least one-third of the daily food needs in all or most nutrients, depending upon age considered, except in respect to calories. Additional calories can be supplied, for example, by a dessert or another slice of bread.

TABLE 17

The Analysis of an Incomplete Lunch

Food item	Weight (gm)	Food energy (cal)	Protein (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Egg, hard-boiled	45	71	5.8	24	1.2	513	.05	.15	Trace	0
Bread, white, enriched, 2 slices	40	104	3.4	22	0.8	0	.10	.06	0.8	0
Jam, 4 T	80	232	0.4	8	0.4	8	Trace	Trace	Trace	4
Cocoa, with milk and water, 1 C	...	139	4.7	142	0.3	192	.05	.22	0.2	1
Total		546	14.3	196	2.7	713	.20	.43	1.0	5
Percentage of Day's Needs										
Child: 7–9 years old		27	24	20	27	20	20	29	10	7
Girl: 13–15 years old		21	18	15	18	14	15	22	8	6
Boy: 16–20 years old		14	14	14	18	12	12	17	6	5
Woman: Moderately active		23	24	20	23	14	17	29	18	7
Man: Physically active		18	20	20	23	14	13	24	7	7

Note: This lunch does not supply the recommended one-third of the day's needs for any nutrient for any of the five individuals listed. What additions to these foods would make it a balanced lunch?

TABLE 18

The Analysis of a Balanced Dinner

Food item	Weight (gm)	Food energy (cal)	Protein (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Pork, cooked, 3 oz	100	352	14.5	8	2.2	0	.60	.16	3.5	0
Potatoes, boiled, 2 small	200	170	4.0	22	1.4	40	.16	.06	2.0	16
Beets, cooked, ½ C	80	37	1.3	22	0.8	16	.01	.03	0.2	4
Beet greens, cooked, ½ C	100	33	2.0	...	3.2	6,700	.04	.14	0.2	17
Bread, white, enriched, 2 slices	40	104	3.4	22	0.8	0	.10	.06	0.8	0
Margarine, 2 pats or 1 T	14	103	0.1	Trace	Trace	277	0	0	0	0
Rice pudding, ½ C	...	185	7.7	113	0.9	473	.07	.25	0.3	1
Milk, fresh whole, 1 large glass	245	169	8.6	289	.17	392	.10	.42	0.2	2
Total		1,153	41.6	476	9.47	7,898	1.08	1.12	7.2	40
		Percentage of Day's Needs								
Child: 4–6 years old		58	69	48	95	226	108	75	72	67
Girl: 13–15 years old		44	52	37	63	158	83	56	55	50
Boy: 16–20 years old		30	42	34	63	132	64	45	42	40
Woman: Moderately active		48	69	48	79	158	90	75	60	57
Man: Physically active		38	59	48	79	158	72	62	48	53

Note: The dinner supplies 40 percent or more of each nutrient in almost every instance, if each of the five individuals eat the same amounts of food. The child and the woman, however, probably will not eat as much as the others. If the man and the woman drink coffee instead of milk, the percentages will drop, but only for calcium will it be important, the figure being brought down to 20 percent. This dinner is from A Sample Meal Guide for One Week on pages 382 and 383.

TABLE 19
The Analysis of One Complete Day's Diet

Food item	Weight (gm)	Food energy (cal)	Protein (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Breakfast										
Grapefruit juice, canned, 1/2 C	100	41	0.5	8	0.4	Trace	.03	.02	0.2	35
Griddle cakes, 4 4 1/2 in. dia.	...	376	14.4	188	2.4	280	.40	.48	2.8	Trace
Sirup, 4 T	80	236	0	36	3.2	0	0	Trace	Trace	0
Milk, whole, 1 large glass (for children)	245	169	8.6	289	.17	392	.10	.42	0.2	2
Total for breakfast		822	23.5	521	6.17	672	.53	.92	3.2	37
Lunch or Supper										
Omelet, 1 medium egg	...	118	6.3	43	1.2	702	.06	.18	Trace	Trace
Potatoes, home-fried, 1/2 C	...	265	2.0	11	0.7	20	.08	.03	1.0	8
Salad: Apple, 1 small, 2 1/4 in. dia.	100	64	0.3	6	0.3	90	.04	.02	0.2	5
Celery, 1/2 C of 1/4 in. pieces	60	13	0.8	30	0.3	0	.02	.02	0.2	4
Biscuits, 2 baking powder	...	224	6.0	56	1.2	66	.20	.18	1.6	Trace
Butter, 2 pats	14	102	Trace	2	.02	462	Trace	Trace	Trace	0
Milk, whole, 1 glass	245	169	8.6	289	0.17	392	.10	.42	0.2	2
Total for lunch		955	24.0	437	3.89	1,732	.50	.65	3.2	19

Table 19 (Continued)

Food item	Weight (gm)	Food energy (cal)	Protein (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Dinner										
Pork, roast shoulder, 1 serving	100	352	14.5	8	2.2	0	.60	.16	3.5	0
Sweetpotato, baked, 1 medium	160	200	2.9	48	1.1	12,320	.11	.08	0.9	18
Peas, green, canned, 1/2 C	100	69	3.4	25	1.8	540	.11	.06	0.9	8
Coleslaw, shredded cabbage, 5/8 C	50	14	0.7	23	0.2	40	.04	.03	0.2	26
Bread, white, enriched, 2 slices	40	104	3.4	22	0.8	0	.10	.06	0.8	0
Margarine, 2 pats or 1 T	14	103	0.1	Trace	Trace	277	0	0	0	0
Gingerbread, 1 serving	...	108	1.6	42	1.4	92	.08	.06	0.9	0
Milk, whole, 1 glass	245	169	8.6	289	0.17	392	.10	.42	0.2	2
Total for dinner		1,119	35.2	457	7.67	13,661	1.14	.87	7.4	54
Day's total for three meals		2,896	82.7	1,415	17.73	16,065	2.17	2.64	13.8	110

Note: This day's diet is from A Sample Meal Guide for One Week on pages 382 and 383. A few minor changes have been made in order that all the above foods may be found in Table 10.

TABLE 20

Percentages of Day's Needs Supplied by Diet in Table 19

Meals	*Food energy (cal)*	*Protein (gm)*	*Calcium (mg)*	*Iron (mg)*	*Vitamin A (I.U.)*	*Thiamine (mg)*	*Riboflavin (mg)*	*Niacin (mg)*	*Ascorbic acid (mg)*
Child—7–9 years old									
Breakfast	41	39	52	62	19	53	61	32	61
Lunch	48	40	43	39	50	50	57	32	32
Dinner	56	59	46	77	390	114	58	74	90
Total	145	138	141	178	459	217	176	138	183
Girl—13–15 years old									
Breakfast	31	29	40	41	13	41	46	25	46
Lunch	37	30	34	26	35	38	42	25	24
Dinner	43	44	35	51	273	88	44	57	67
Total	111	103	109	118	321	167	132	107	137
Boy—16–20 years old									
Breakfast	22	24	37	41	11	31	37	19	37
Lunch	25	24	31	26	29	29	34	19	19
Dinner	29	35	33	51	228	67	35	43	54
Total	76	83	101	118	268	127	106	81	110
Woman—Moderately active									
Breakfast	34	39	52	51	13	44	61	27	53
Lunch	40	40	43	32	35	42	57	27	27
Dinner	47	59	47	64	273	95	58	61	77
Total	121	138	142	147	321	181	176	115	157
Man—Physically active									
Breakfast	27	34	52	51	13	35	51	21	49
Lunch	32	34	44	32	35	33	47	21	25
Dinner	37	50	46	64	273	76	48	50	72
Total	96	118	142	147	321	144	146	92	146

APPENDIX C

HEIGHT-WEIGHT TABLES

Table 21: Average Weight for Height of Girls from 5 to 18 Years

Table 22: Average Weight for Height of Boys from 5 to 19 Years

Table 23: Ideal Weights for Women, Ages 25 and Over

Table 24: Ideal Weights for Men, Ages 25 and Over

APPENDIX C

Height-Weight Tables

TABLE 21

Average Weight for Height of Girls from 5 to 18 Years*

Height (in.)	Years 5	6	7	8	9	10	11	12	13	14	15	16	17	18
38	33	33												
39	34	34												
40	36	36	36											
41	37	37	37											
42	39	39	39											
43	41	41	41	41										
44	42	42	42	42										
45	45	45	45	45	45									
46	47	47	47	48	48									
47	49	50	50	50	50	50								
48		52	52	52	52	53	53							
49		54	54	55	55	56	56							
50		56	56	57	58	59	61	62						
51			59	60	61	61	63	65						
52			63	64	64	64	65	67						
53			66	67	67	68	68	69	71					
54				69	70	70	71	71	73					
55				72	74	74	74	75	77	78				
56					76	78	78	79	81	83				
57					80	82	82	82	84	88	92			
58						84	86	86	88	93	96	101		
59						87	90	90	92	96	100	103	104	
60						91	95	95	97	101	105	108	109	111
61							99	100	101	105	108	112	113	116
62							104	105	106	109	113	115	117	118
63								110	110	112	116	117	119	120
64								114	115	117	119	120	122	123
65								118	120	121	122	123	125	126
66									124	124	125	128	129	130
67									128	130	131	133	133	135
68									131	133	135	136	138	138
69										135	137	138	140	142
70										136	138	140	142	144
71										138	140	142	144	145

Note: It is recommended that weighing be done at about the same time of the day, once a month if possible, in clothes ordinarily worn in the classroom. The shoes should be removed. It is suggested that height be recorded three times a year— in September, February, and June.

* Prepared by Bird T. Baldwin, Ph. D., and Thomas D. Wood, M. D.

TABLE 22

Average Weight for Height of Boys from 5 to 19 Years*

Height (in.)	Years 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
38	34	34													
39	35	35													
40	36	36													
41	38	38	38												
42	39	39	39	39											
43	41	41	41	41											
44	44	44	44	44											
45	46	46	46	46	46										
46	47	48	48	48	48										
47	49	50	50	50	50	50									
48		52	53	53	53	53									
49		55	55	55	55	55	55								
50		57	58	58	58	58	58	58							
51			61	61	61	61	61	61							
52			63	64	64	64	64	64	64						
53			66	67	67	67	67	68	68						
54				70	70	70	70	71	71	72					
55				72	72	73	73	74	74	74					
56				75	76	77	77	77	78	78	80				
57					79	80	81	81	82	83	83				
58					83	84	84	85	85	86	87				
59						87	88	89	89	90	90	90			
60						91	92	92	93	94	95	96			
61							95	96	97	99	100	103	106		
62							100	101	102	103	104	107	111	116	
63							105	106	107	108	110	113	118	123	127
64								109	111	113	115	117	121	126	130
65								114	117	118	120	122	127	131	134
66									119	122	125	128	132	136	139
67									124	128	130	134	136	139	142
68										134	134	137	141	143	147
69										137	139	143	146	149	152
70										143	144	145	148	151	155
71										148	150	151	152	154	159
72											153	155	156	158	163
73											157	160	162	164	167
74											160	164	168	170	171

Note: It is recommended that weighing be done at about the same time of the day, once a month if possible, in clothes ordinarily worn in the classroom. The shoes should be removed. It is suggested that height be recorded three times a year—in September, February, and June.

* Prepared by Bird T. Baldwin, Ph. D., and Thomas D. Wood, M. D.

TABLE 23
Ideal Weights for Women, Ages 25 and Over*

Height (with shoes) (ft–in.)	Weight (as ordinarily dressed)		
	Small frame (lb)	Medium frame (lb)	Large frame (lb)
4–11	104–111	110–118	117–127
5–0	105–113	112–120	119–129
5–1	107–115	114–122	121–131
5–2	110–118	117–125	124–135
5–3	113–121	120–128	127–138
5–4	116–125	124–132	131–142
5–5	119–128	127–135	133–145
5–6	123–132	130–140	138–150
5–7	126–136	134–144	142–154
5–8	129–139	137–147	145–158
5–9	133–143	141–151	149–162
5–10	136–147	145–155	152–166
5–11	139–150	148–158	155–169

Note: The tables on height-weight here included do not supply information on ideal weights for women for ages nineteen to twenty-four. To arrive at an average weight for a given height for this age period, it is suggested that a weight figure be selected between that given for age eighteen in Table 21 and that given for age twenty-five in the above table.

* Metropolitan Life Insurance Company, Statistical Bureau, 1943.

TABLE 24
Ideal Weights for Men, Ages 25 and Over*

Height (with shoes) (ft–in.)	Weight (as ordinarily dressed)		
	Small frame (lb)	Medium frame (lb)	Large frame (lb)
5–2	116–125	124–133	131–142
5–3	119–128	127–136	133–144
5–4	122–132	130–140	137–149
5–5	126–136	134–144	141–153
5–6	129–139	137–147	145–157
5–7	133–143	141–151	149–162
5–8	136–147	145–156	153–166
5–9	140–151	149–160	157–170
5–10	144–155	153–164	161–175
5–11	148–159	157–168	165–180
6–0	152–164	161–173	169–185
6–1	157–169	166–178	174–190
6–2	163–175	171–184	179–196
6–3	168–180	176–189	184–202

Note: The tables on height-weight here included do not supply information on ideal weights for men for ages twenty to twenty-four. To arrive at an average weight for a given height for this age period, it is suggested that a weight figure be selected between that given for age nineteen in Table 22 and that given for age twenty-five in the above table.

* Metropolitan Life Insurance Company, Statistical Bureau, 1943.

APPENDIX D

TABLES FOR FAMILY FOOD PLANS AT LOW AND MODERATE COSTS

Table 25: Master Food Plan at Low Cost

Table 26: Master Food Plan at Moderate Cost

A Sample Meal Guide for One Week

APPENDIX D

Tables for Family Food Plans at Low and Moderate Costs

Two family food plans for a week are here included. Table 25 considers a food plan at a low cost. Table 26 presents a food plan at a moderate cost. These plans are from *Helping Families Plan Food Budgets*, Miscellaneous Publication 662, 1948, Government Printing Office, Washington, D.C. That publication also contains additional suggestions for family food plans, including a second low-cost plan which is about 15 percent cheaper than the one listed here.

How to use these food plans:

1. Prepare a table with 12 columns and headings, as in the following tables. In the first column, "Family members," of your table write down the name of each person who eats at your family table. Put the name of each person on a separate line.

2. Find the line in the following tables which describes each person. For example, if Susan is fourteen years old, the foods which she needs are on the line "Girls: 13–15 years."

3. Now, beside each name that you write down in your table, fill in the quantities of foods which the table recommends for a person of that sex, age, and activity. (Susan, again, would need 6½ quarts of milk on the low-cost plan.)

4. When all the quantities are filled in, add up each food column. Remember: 1 pound = 16 ounces; 1 pint = 16 ounces; 1 quart = 2 pints; 1 pint = 2 cups.

There you have your family's marketing list for the week.

Just how much it will cost to follow any diet plan depends upon several things—family size, the general level of food prices, the food choices made within various food groups, the importance which the family attaches to food, and the skill and thrift of the person who buys the food and prepares it.

Those families which can afford to spend more for their meals than low-cost diets require probably will wish to follow the moderate-cost plan. Also, families producing a considerable share of their food at home usually can have more liberal diets.

For a family planning to produce the whole amount of any one or more of various kinds of food needed throughout the year: Multiply the quantities that the family needs for a week by 52. Then add something extra (from one-fourth to one-half) for guests and for a margin of safety.

The same adjustment has been made in the two plans for losses of vitamins in cooking. Although neither plan allows for much waste in food preparation, the moderate-cost plan has slightly more leeway than the low-cost plan.

TABLE 25

Master Food Plan at Low Cost

(Weekly quantities of food, as purchased, for 19 groups according to age, sex and activity)

Family members	Leafy, green, and yellow vegetables (lb–oz)	Citrus fruit, tomatoes (lb–oz)	Potatoes, sweet-potatoes (lb–oz)	Other vegetables and fruit (lb–oz)
Children through 12 years:				
9–12 months	1– 8	1–12	0–8	1– 0
1–3 years	1–12	1–12	1–0	1– 0
4–6 years	1–12	1–12	1–8	1– 4
7–9 years	2– 0	2– 0	2–8	1– 8
10–12 years	2– 4	2– 4	3–0	1–12
Girls:				
13–15 years	2– 4	2– 4	3–4	1–12
16–20 years	2– 4	2– 4	3–0	1–12
Boys:				
13–15 years	2– 8	2– 8	4–0	2– 4
16–20 years	2–12	2– 8	5–0	2– 8
Women:				
Sedentary	2– 4	2– 0	2–4	1–12
Moderately active	2– 4	2– 0	3–0	1–12
Very active	2– 8	2– 8	4–0	2– 0
Pregnant	3– 0	2– 8	2–8	2– 0
Nursing	3– 8	3–12	4–0	2– 4
60 years or over[5]	2– 8	2– 4	2–8	1–12
Men:				
Sedentary	2– 4	2– 0	3–0	1–12
Physically active	2– 8	2– 8	4–0	2– 0
With heavy work	2– 8	2– 8	6–0	2– 8
60 years or over[5]	2– 8	2– 4	3–4	1–12

[1] Or its equivalent in cheese, evaporated milk, or dry milk.

[2] Count 1½ pounds of bread as 1 pound of flour. Use as much as possible in the form of whole-grain, enriched, or restored products.

[3] For small children and pregnant and nursing women, cod-liver oil or some other source of vitamin D is also needed. For elderly persons and for persons who have no opportunity for exposure to clear sunshine, a small amount of vitamin D is also desirable.

[4] To meet iron allowance, 1 large or 2 small servings of liver or other organ meats should be served each week.

[5] The nutritive content of the weekly food quantities for a man and a woman 60 years or over were based on the National Research Council's recommended daily allowances for the sedentary man and woman.

Milk[1] (qt)	Meat, poultry, fish (lb–oz)	Eggs (No.)	Dry beans and peas, nuts (lb–oz)	Flour, cereals[2] (lb–oz)	Fats and oils[3] (lb–oz)	Sugar, sirups, preserves (lb–oz)
6	0– 4	5	0– 1	0–10	0– 1	0– 1
5½	0– 8[4]	5	0– 1	1– 4	0– 2	0– 2
5½	1– 0	5	0– 2	1–12	0– 6	0– 6
5½	1– 8	5	0– 4	2– 4	0– 8	0–10
6	1–12	5	0– 4	3– 4	0–12	0–12
6½	2– 0[4]	5	0– 4	3– 8	0–12	0–12
5	2– 0[4]	5	0– 4	3– 4	0–12	0–10
6½	2– 0	5	0– 8	4– 8	1– 0	0–14
6½	2– 0	5	0– 8	5–12	1– 6	1– 0
5	2– 0	5	0– 4	2– 0	0–10	0–10
5	2– 0	5	0– 4	3– 4	0–12	0–12
5	2– 0	5	0– 6	4– 4	1– 0	1– 0
7½	2– 4[4]	7	0– 4	2– 8	0–10	0– 8
10½	2– 8[4]	7	0– 4	3– 0	0–10	0– 8
5	2– 0	4	0– 2	2– 4	0– 8	0– 8
5	2– 0	5	0– 4	3– 4	0–12	0–12
5	2– 0	5	0– 6	4– 4	1– 0	1– 0
5	2– 0	5	0–10	7–12	1–14	1– 0
5	2– 0	4	0– 2	3– 4	0–10	0–10

TABLE 26

Master Food Plan at Moderate Cost

(Weekly quantities of food, as purchased, for 19 groups according to age, sex, and activity)

Family members	Leafy, green, and yellow vegetables (lb–oz)	Citrus fruit, tomatoes (lb–oz)	Potatoes, sweet-potatoes (lb–oz)	Other vegetables and fruit (lb–oz)
Children through 12 years:				
9–12 months	1– 8	1–12	0– 8	1– 0
1–3 years	2– 0	2– 0	0– 8	1–12
4–6 years	2– 4	2– 4	1– 0	2– 4
7–9 years	2– 8	2– 8	1–12	2– 8
10–12 years	3– 0	2–12	2– 4	2– 8
Girls:				
13–15 years	3– 8	2–12	2– 8	3– 8
16–20 years	3– 8	2–12	2– 8	3– 8
Boys:				
13–15 years	3– 8	3– 0	3– 8	3– 8
16–20 years	4– 0	3– 8	4– 8	3– 8
Women:				
Sedentary	3– 4	2– 8	1–12	3– 4
Moderately active	3– 8	2– 8	2– 8	3– 8
Very active	3–12	3– 0	3– 4	4– 0
Pregnant	4– 0	3– 8	2– 4	3– 0
Nursing	4– 0	4– 8	3– 0	3– 8
60 years or over[5]	3– 8	2–12	2– 0	3– 0
Men:				
Sedentary	3– 8	2– 8	2– 8	3– 8
Physically active	3–12	3– 0	3– 4	4– 0
With heavy work	4– 0	3– 8	5– 0	4– 4
60 years or over[5]	3– 8	2–12	2–12	3– 0

[1] Or its equivalent in cheese, evaporated milk, or dry milk.

[2] Count 1½ pounds of bread as 1 pound of flour. Use as much as possible in the form of whole-grain, enriched, or restored products.

[3] For small children and pregnant and nursing women, cod-liver oil or some other source of vitamin D is also needed. For elderly persons and for persons who have no opportunity for exposure to clear sunshine, a small amount of vitamin D is also desirable.

[4] To meet iron allowance, 1 large or 2 small servings of liver or other organ meats should be served each week.

[5] The nutritive content of the weekly food quantities for a man and woman 60 years or over were based on the National Research Council's recommended daily allowances for the sedentary man and woman.

Milk[1] (qt)	Meat, poultry, fish (lb–oz)	Eggs (No.)	Dry beans and peas, nuts (lb–oz)	Flour, cereals[2] (lb–oz)	Fats and oils[3] (lb–oz)	Sugar, sirups, preserves (lb–oz)
6	0– 4	5	0–1	0–10	0– 1	0– 1
6	0–12[4]	6	0–1	1– 4	0– 2	0– 2
6	1– 4	7	0–1	1– 8	0– 6	0– 8
6½	1–12	7	0–2	2– 0	0– 8	0–12
7	2– 4	7	0–2	2–12	0–12	0–14
7	2–12[4]	7	0–2	2–12	0–14	0–14
6	2–12[4]	7	0–2	2– 8	0–12	0–14
7	3– 0	7	0–4	4– 0	1– 2	1– 2
7	3– 4	7	0–6	5– 4	1– 6	1– 4
5	2– 8	7	0–1	1–12	0–10	0–12
5	2–12	7	0–2	2– 8	0–14	0–14
5	3– 0	7	0–4	3–12	1– 2	1– 2
7½	3– 0[4]	7	0–2	2– 4	0–10	0–10
10½	3– 0[4]	7	0–2	2– 8	0–12	0–12
5½	2– 8	6	0–1	1–12	0– 8	0–10
5	2–12	7	0–2	2– 8	0–14	0–14
5	3– 0	7	0–4	3–12	1– 2	1– 2
5	3– 8	7	0–6	7– 0	2– 0	1– 4
5½	2–12	6	0–2	2– 8	0–12	0–12

A SAMPLE MEAL GUIDE FOR ONE WEEK[1]

Sunday

Breakfast

Orange juice
Wheat griddle cakes with sirup
Milk for children

Dinner

Roast shoulder of pork with stuffing
Sweetpotatoes
(roasted in pan with meat)
Green beans — Coleslaw
Bread — Butter or margarine
Gingerbread

Supper

Poached or scrambled eggs
Home-fried potatoes
Apple and celery salad
Biscuits — Butter or margarine
Milk

Monday

Breakfast

Grapefruit juice
Hot wheat cereal with milk
Toast — Butter or margarine
Milk for children

Lunch or *Supper*

Egg salad sandwich
Peanut butter and shredded-lettuce sandwich
Gingerbread
Milk

Dinner

Pork pie with potatoes
Sour beets and beet greens
Bread — Butter or margarine
Rice pudding

Tuesday

Breakfast

Tomato juice
French toast — Sirup
Milk for children

Lunch or *Supper*

Cheese and lettuce sandwiches
Beet and green bean salad
Graham crackers
Milk

Dinner

Spaghetti with meat balls
Salad bowl: Lettuce, celery, carrot, cabbage
Homemade rolls
Butter or margarine
Baked apple with top milk

Wednesday

Breakfast

Stewed prunes
Ready-to-eat cereal with milk
Toasted rolls — Butter or margarine
Milk for children

Lunch or *Supper*

Meat turnover — Potato salad
Vegetable slaw: Cabbage, minced onion, radish slices, and dressing
Peanut butter cookies

Dinner

Lima bean–tomato casserole
Spinach
Corn-meal muffins
Butter or margarine
Sweetpotato custard

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[1] Adapted from *Food for Families with School Children*, U.S. Department of Agriculture, 1948, pp. 18–21.

THURSDAY

Breakfast

Grapefruit juice
Hot wheat cereal with milk
Toast — Butter or margarine
Milk for children

Lunch or *Supper*

Lima bean soup
Cottage cheese and lettuce sandwich on raisin bread
Oatmeal cookies
Milk

Dinner

Veal loaf with brown gravy
Scalloped potatoes — Carrots
Orange, chopped prune, and cabbage salad
Bread — Butter or margarine
Butterscotch pudding

FRIDAY

Breakfast

Stewed apricots
Oatmeal and milk
Toast — Butter or margarine
Milk for children

Lunch or *Supper*

Potato and onion soup
Deviled egg sandwich, or deviled egg salad for those at home
Celery
Bread — Butter or margarine
Orange
Milk

Dinner

Scalloped salmon
Mashed potatoes
Green peas and onions
Bread — Butter or margarine
Apple pie

SATURDAY

Breakfast

Orange juice
Fried corn-meal mush with sirup
Milk for children

Lunch or *Supper*

Sliced veal loaf with gravy
Potato cakes — Shredded carrot salad
Pickles
Bread — Butter or margarine
Oatmeal drop cookies
Milk

Dinner

Braised liver or kidneys
Riced potatoes — 5-minute cabbage
Jellied tomato and cottage cheese salad
Bread — Butter or margarine
Chocolate bread pudding

APPENDIX E

NUTRITION EXPERIMENTS WITH ANIMALS

APPENDIX E

Nutrition Experiments with Animals

The effects of good and poor diets can quickly be shown with certain animals which have short life spans. Animals commonly used for such experiments or demonstrations are the white rat and the guinea pig.

We shall describe here briefly some such experiments with the white rat which can be carried out easily in school. Additional experiments, as well as information concerning the care of animals, equipment, weighing, and keeping records, are given in detail in the references listed on page 389.

The white rat lends itself to nutrition experiments because it is clean and easily handled, eats practically everything, and reacts to food largely in the same way that humans do.

Rats have a life span of about 3 years. Defects resulting from inadequate diets show up quickly because of the rat's rapid growth. A white rat is usually started on a feeding demonstration when four weeks old, which age is comparable to that of a child of about two and one-half years. When the experiment is completed 8 weeks later, the rat corresponds in age to that of a child of seven. A three-year-old rat corresponds in age to a ninety-year-old man.

It is best to use two or more rats of the same age and sex, and from the same litter. At the start of the demonstration they should be about twenty-eight days old. They should also be about the same weight—around 50 grams or 1¾ ounces. Use two diets—one which is good and a second which is inadequate in some specific respect. The two diets should be run at the same time, with one or more rats on each diet. The diets of the rats may be reversed at the end of 5 or 6 weeks in order to show that the good diet helps the rat which has been on the poor diet.

Except for the use of different diets, the following steps apply to all the nutrition demonstrations. Weigh each rat at the beginning of the experiment and weekly thereafter for the 6 to 8 weeks of the experiment. A growth chart should be used, since this makes it easier to follow the progress of each rat. Daily records should be kept of the appearance, activity, and disposition of the animals. Changes which have occurred within the body may be observed through dissection. It may be desirable to remove and mount the skeleton in those studies where the bone (and tooth) growth has been affected.

The foods used in a given diet should be dried, ground, and mixed. This procedure prevents the animal from selecting or discarding special foods in the diet. It also assures the use of the same diet throughout the period of the experiment.

DIET 1. To demonstrate the effect of a lack of vitamin D

Poor Diet

Yellow corn	76 parts
Gluten flour	20 parts
Sodium chloride	1 part
Calcium carbonate	3 parts

Since this diet is lacking in vitamin D, it will produce rickets in the white rats.

Good Diet

The second group of rats is placed on a diet which is identical with the other one except that a source of vitamin D is added. For this purpose use 20 drops of viosterol per thousand grams of diet.

About $2\frac{1}{2}$ to 3 pounds of each of the diets will be required if four animals are used in the experiment.

The effects of vitamin-D deficiency will be evidenced within 30 days by cessation of growth; wobbly, uncertain gait; weak bones; bowleggedness in severe stage; and a general unhealthy appearance.

The recovery of the rats which have been on the deficient diet can be demonstrated by placing them on the diet which contains viosterol. These animals should gain in weight almost immediately if they have not already developed too severe a case of rickets.

DIET 2. To demonstrate the comparative growth value of milk and some other beverage

Poor Diet

Whole-grain bread or cereal plus one of the following beverages —water, coffee, tea, soft drink.

Good Diet

Whole-grain bread or cereal plus milk.

In the case of the good diet, the water cup should be removed until the rat has taken all the milk. Similarly, on the poor diet, the beverage selected should be substituted for water, unless water alone is used.

DIET 3. To demonstrate the comparative growth value of a good and a poor lunch

Poor Diet	*Good Diet*
Bread and jelly, soft drink, and candy.	Cheese, vegetable, bread, butter, and milk.

The success of this experiment is dependent largely upon the withholding of water until the rat on the good diet has consumed all the milk that it will take.

People of course eat a more varied diet than is represented by this lunch as well as the previous one.

DIET 4. To demonstrate the effect of a lack of vitamin C.

White rats cannot be used for this experiment, since they are able to synthesize vitamin C in their own bodies. Guinea pigs should be used instead. They react in the same way that man does to a lack of this vitamin. (The monkey is the only other animal which reacts like man to vitamin C.) Additional information about the care of guinea pigs can be obtained from the references listed on page 389.

Poor Diet		*Good Diet*
Rolled oats.	450 grams	The same as the poor diet, plus daily 2 ounces of raw carrot or the same amount of a green vegetable.
Wheat bran.	225 grams	
Skim-milk powder.	300 grams	
Cod-liver oil.	20 grams	
Sodium chloride.	10 grams	

Watch daily for any of the following signs of scurvy: inactivity and general weakness; soreness of wrist or knee joints, as shown by the guinea pigs' crying when handled; enlarged joints; nervousness; dull eyes; awkward gait or inability to use the legs properly. The teeth may loosen and drop out if the scurvy is very severe.

After definite signs of scurvy have developed, show that the animal can recover by feeding, with a medicine dropper, one teaspoon of orange or tomato juice daily.

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Information in regard to farm animal-feeding experiments may be obtained from the state college, the county agricultural agent, or an agriculture teacher.

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LIST OF VISUAL AIDS

The following list of visual materials can be used to supplement some of the material in this book. These films can be obtained from the producer or distributor listed with each title. (The addresses of producers and distributors are given on page 399.) In many cases these films can be obtained from your local film library or local film distributor; also, many universities have large film libraries from which they can be borrowed.

The running time (min), whether it is silent (si) or sound (sd), and whether it is available for sale, rental, or loan are listed with each title. All the motion pictures are 16-mm black and white films, unless otherwise stated.

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Energy Release from Food (Upjohn 1946 25min sd color loan). Explains the action of vitamin-B complex in the body.

Feeding Farm Animals (Castle 1946 18min sd sale). Balanced diet shown in feeding various types of livestock.

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Hidden Hunger (Swift 1941 30min sd loan). A farmer conducts a one-man campaign to improve the eating habits of the nation.

Magic Food (General Pictures 1947 10min sd b&w and color sale). Magician uses basic foods to do magic. Food groups and correct meals are discussed.

Making Ends Meet (Dairy Council 1942 12min sd color sale, loan). Demonstrates that inexpensive meals can improve our health and

standard of living. Shows attractive preparation of food and explains relationship of milk to the rest of the diet.

Man Who Missed His Breakfast (Castle—U.S. Department of Agriculture film—1944 28 min sd sale). A story of nutrition, explained by one family's needs; shows the seven groups of nutritional foods.

Precious Ingredient (Westinghouse 25min sd loan). Explains the significance of vitamins and shows the importance of protecting them in cooking food.

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Strange Hunger (Modern 1948 33min sd loan) Pictures need and use of niacin, riboflavin, thiamine, and other vitamins in the human body.

Two Little Rats and How They Grew (Dairy Council 1946 11min sd sale, loan). School children conduct a white-rat-feeding experiment to learn about the foods which promote growth.

Vitamin D (EBF 1941 15min si sale). Shows how modern living reduces vitamin D benefits and the results of such a lack.

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